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NATIONAL DAM SAFETY PROGRAM. LAKE MUSCONETCONG DAM(NJ00328). DE--ETC(U)
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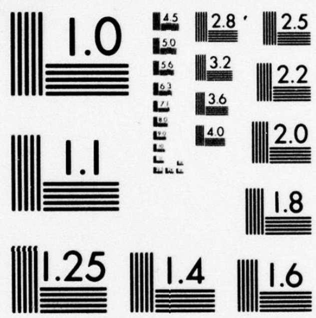
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DELAWARE RIVER BASIN
MUSCONETCONG RIVER
MORRIS COUNTY
NEW JERSEY

LAKE MUSCONETCONG DAM

NJ 00328

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

LEVEL II

Approved for public release;
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DEPARTMENT OF THE ARMY

Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

April, 1979

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Safety
Visual Inspection
National Dam Inspection Act
Morris County, N.J.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE–2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-D

12 APR 1979

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Lake Musconetcong Dam in Morris County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Lake Musconetcong Dam, a high hazard potential structure, is judged to be in fair overall condition. However, the spillway is considered inadequate since 72 percent of the Probable Maximum Flood (PMF) would overtop the dam. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within six months from the date of approval of this report, engineering studies and analysis should be performed to determine the dam's foundation conditions and structural stability. Any remedial measures found necessary should be initiated within calendar year 1980.

c. Within six months of the date of approval of this report, the following remedial actions should be completed:

(1) Trashracks should be installed at the gatehouse intake. A means of hoisting the trashrack into and out of its channels should also be provided.

(2) The crack in the joint of the downstream face of the spillway should be repaired.

(3) Inspection and repair, if necessary, of the concrete of the spillway discharge channel at the upstream toe of the dam should be performed when no water is flowing over the spillway.

(4) Spalled and eroded areas on the downstream face of the spillway, the sidewalls, the discharge outlet structure, and the upstream end of the culvert under Route 206 should be repaired.

(5) An evaluation should be made of the ability of the iron picket fence, along Route 206, to stop a fast moving heavy vehicle from accidently falling into the spillway discharge channel.

(6) Within twelve months, from the date of approval of this report, the depression in the concrete sidewalk along Route 206 should be investigated and repaired.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman James J. Courter of the Thirteenth District. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

NAPEN-D
Brendan T. Byrne

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

Joel Kollister LTC

1 Incl
As stated

JAMES G. TON
Colonel, Corps of Engineers
for District Engineer

Copies furnished:
Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N. J. Dept. of Environmental Protection
P. O. Box CN029
Trenton, NJ 08625

John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N. J. Dept. of Environmental Protection
P. O. Box CN029
Trenton, NJ 08625

LAKE MUSCONETCONG DAM (NJ00328)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 7 and 14 December 1978 by Langan Engineering Associates, Inc. under contract to the State of New Jersey. The state, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Lake Musconetcong Dam, a high hazard potential structure, is judged to be in fair overall condition. However, the spillway is considered inadequate since 72 percent of the Probable Maximum Flood (PMF) would overtop the dam. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within six months from the date of approval of this report, engineering studies and analysis should be performed to determine the dams foundation conditions and structural stability. Any remedial measures found necessary should be initiated within calendar year 1980.

c. Within six months of the date of approval of this report, the following remedial actions should be completed:

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(5) An evaluation should be made of the ability of the iron picket fence, along Route 206, to stop a fast moving heavy vehicle from accidently falling into the spillway discharge channel.

(6) Within twelve months, from the date of approval of this report, the depression in the concrete sidewalk along Route 206 should be investigated and repaired.

APPROVED: Joel Kelleher LTC
JAMES G. TON
Colonel, Corps of Engineers
for District Engineer

DATE: 12 April 1979

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NAME OF DAM:	LAKE MUSCONETCONG DAM
ID NUMBER:	FED ID No NJ00328
STATE LOCATED:	NEW JERSEY
COUNTY LOCATED:	MORRIS
STREAM:	MUSCONETCONG RIVER
RIVER BASIN:	DELAWARE
DATE OF INSPECTION:	DECEMBER 1978

ASSESSMENT OF GENERAL CONDITIONS

Lake Musconetcong is 52 years old and in fair overall condition. There is spalling, deterioration, and cracking of concrete at different locations on the dam, spillway, and outlet works that should be repaired.

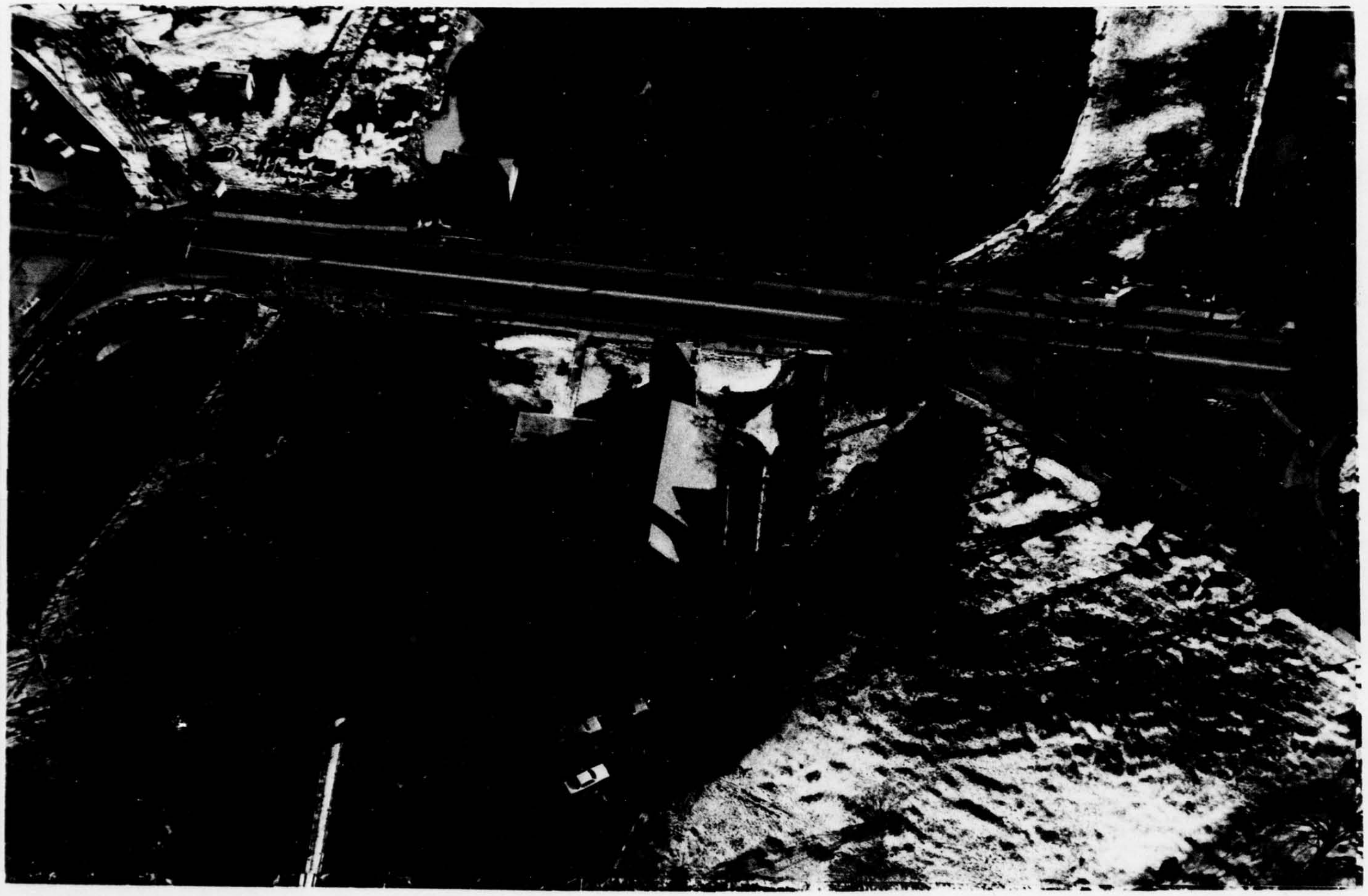
The spillway capacity as determined by CE Screening criteria is inadequate. We estimate the dam can adequately pass 71% of the PMF. We recommend trashracks be installed at the gatehouse intake. A means of hoisting the trashrack into and out of its channels should also be provided. This should be done soon. The crack in the joint of the downstream face of the spillway should be repaired. This should be done soon. An inspection of the concrete of the spillway discharge channel at the upstream toe of the dam should be performed when no water is flowing over the spillway. This should be done soon. The engineering properties of the dam foundation material should be investigated by means of borings and tests, and stability analysis made using present day methods to confirm our assumptions concerning the structural

stability of the dam and appurtenances under different stress conditions. This should be done soon. Spalled and eroded areas on the downstream face of the spillway, the sidewalls, the discharge outlet structure, and the upstream end of the culvert under Route 206 should be repaired. This should be done in the near future. The iron picket fence along Route 206 should be cleaned and painted and an evaluation made of its ability to stop a fast moving heavy vehicle from accidentaly falling into the spillway discharge channel. This should be done in the near future. The depression of the concrete sidewalk along Route 206 should be investigated and repaired. This should be done in the future.

The spillway capacity as determined by CE Screening criteria is inadequate. The actual capacity of the spillway and the SDF should be determined using more precise and sophisticated methods and procedures. The need for and type of mitigating measures should be determined. Around the clock surveillance during periods of unusually heavy precipitation should be provided, and a warning system established. This should be done in the near future.

Dennis J. Leary

Dennis J. Leary, P.E.



OVERVIEW

LAKE MUSCONETCONG DAM

1 DECEMBER 1978

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NAME OF DAM:	LAKE MUSCONETCONG DAM
ID NUMBER:	FED ID No NJ00328
STATE LOCATED:	NEW JERSEY
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LANGAN ENGINEERING ASSOCIATES, INC.

Consulting Civil Engineers

990 CLIFTON AVENUE

CLIFTON, NEW JERSEY

201-472-9366

CONTENTS

NATIONAL DAM SAFETY REPORT

LAKE MUSCONETCONG DAM FED ID No. NJ00328

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

SECTION 1 PROJECT INFORMATION

1.1 General

Authority to perform the Phase I Safety Inspection of Lake Musconetcong Dam was received from the State of New Jersey, Department of Environmental Protection, Division of Water Resources by letter dated 20 November 1978. This Authority was given pursuant to the National Dam Inspection Act, Public Law 92-367 and by agreement between the State and the US Army Corps of Engineers District, Philadelphia, Penn.

The purpose of the Phase I Investigation is to develop an assessment of the general conditions with respect to safety of Lake Musconetcong Dam and appurtenances based upon available data and visual inspection, and, determine any need for emergency measures and conclude if additional studies, investigations and analyses are necessary and warranted. The assessment is made using screening criteria established in Recommended Guidelines for Safety Inspection of Dams prepared by the Department of Army, Office of the Chief of Engineers. It is not the purpose of the inspection report to imply that a dam meeting or failing to meet the screening criteria, is per se, certainly adequate or inadequate.

1.2 Project Description

Lake Musconetcong Dam is a 52 year old, 14-ft high, 237-ft long highway embankment dam (Route 206) with a concrete upstream retaining wall and an upstream over-fall type spillway. The downstream slope of the dam on the west side of Route 206 is about 1½ Hor. to 1 Vert. or flatter. The concrete crest of the spillway has been raised one foot by means of timber planks bolted to the top. There is a longitudinal spillway channel parallel to and upstream of Route 206. The retaining wall forms the downstream side of the spillway channel. There is a gatehouse with four 3-ft-wide by 5-ft-high sluice gates and a 36-in-dia discharge pipe at the right abutment. The spillway is a concrete weir 203 ft long and discharge from the spillway channel is by way of a culvert under Route 206 into the Musconetcong River. The four sluice gates discharge directly into the spillway discharge channel and into the culvert. Discharge from the pipe crosses Route 206 and into the Morris Canal.

The dam is located in the Borough of Netcong on the Musconetcong River Morris County, New Jersey. It is at the southwest end of Lake Musconetcong at north latitude 40° 54' and west longitude 74° 42.3. A regional vicinity map is given in Fig 1 and essential features of the dam and appurtenances are given in Fig 2.

Lake Musconetcong Dam is classified as being "Intermediate" on the basis of its maximum reservoir storage volume of 3370 ac-ft which is more than 1,000-acre feet, but less than 50,000-acre feet. It is classified as "Small" on the basis of its total height of 14 ft, which is less than 40 feet. The overall size classification is the larger of these two determinations, and accordingly the dam is classified as "Intermediate" in size.

In the National Inventory of Dams, Lake Musconetcong Dam has been classified as having "High Hazard Potential" on the basis that failure of the dam would cause excessive property damage to residences downstream, and could potentially cause more than a few deaths. Visual inspection of the downstream area shows that breach of the dam would cause damage to residences and be hazardous to people utilizing Route 206. Accordingly, it is proposed not to change the Hazard Classification Potential.

The dam is owned by the State of New Jersey Department of Environmental Protection, Div. of Parks and Forestry, P.O. Box 1420 Trenton, N.J. 08625.

The purpose of the dam is flood control and recreation. The dam was designed by Corneleus C. Vermeule, Consulting and Direction Engineer for the Morris Canal and Banking Company. It was constructed by the John W. Heller Company in 1927. There is essentially no information available on the design and construction history of the dam.

1.3 Pertinent Data

a.	The drainage area is:	30.3 sq mi
	The area of the Lake is:	307 Acres
b.	Discharge at Dam Site	
	Maximum known flood at dam site:	October 1903; peak flow reported to be 2331 cfs at Lake Hopatcong
	Ungated spillway capacity at maximum pool elevation:	3460 cfs (controlled by culvert under roadway)
	Total spillway capacity at maximum pool elevation:	3460 cfs (controlled by culvert under roadway)
c.	Elevation (ft above MSL)	
	Top dam:	Approx. El. 863.5 (low point at two ends)

	Spillway crest:	El. 859.75
	Streambed at centerline of dam:	Approx. El. 849.
	Maximum tailwater:	Approx. El. 851. at time of inspection
d.	Reservoir	
	Length of maximum pool:	Approx. 14,000 feet
	Length of normal pool:	Approx. 13,900 feet
e.	Storage (acre-feet)	
	Top of dam:	Approx. 3370 AF
	Spillway crest:	Approx. 2200 AF
f.	Reservoir Surface (acres)	
	Top Dam:	Approx. 318 Acres
	Spillway crest:	307 Acres
g.	Dam	
	Type:	Highway embankment with U/S concrete face
	Length:	237 feet
	Height:	14 feet
	Top width:	63 Feet (roadway embankment width)
	Zoning:	None observed
	Impervious Core:	None observed
	Cutoff:	None observed
	Grout curtain:	None observed
h.	Spillway	
	Type:	Over-fall
	Length of weir:	203 feet

Crest elevation:	El. 859.75
U/S Channel:	None observed
D/S Channel:	Longitudinal concrete channel

i. Regulating outlets — Four 3 ft x 5 ft vertical lift sluice gates and a control valve on a pipe leading from the right of the gatehouse. Discharge is controlled from gatehouse at right abutment.

SECTION 2 ENGINEERING DATA

2.1 Introduction

In 1931 consideration was given to raising the crest of the spillway by 2.0 ft. This led to the development of technical letters by the Engineer C.C. Vermeule concerning the hydrologic aspects of Lake Musconetcong and the spillway. These letters are given in Appendix 1. The spillway was not raised as originally proposed. However, the crest was raised 1 ft by means of timber planks bolted to the crest of the existing concrete weir. These planks have been maintained and were in place at the time of our inspection.

No essential engineering information is available concerning the design and construction of the dam. Consequently, an evaluation cannot be made.

Operation of the outlet works consists of maintaining a flow in the pipe leading to the Morris Canal. This water is used by the Stan Hope Fire Department for fire protection. During the winter a flow of water is maintained over the spillway to prevent freezing at the spillway crest and the left sluice gate is kept open slightly to prevent build up of ice and permit measurement of water levels.

2.2 Regional Geology

Lake Musconetcong Dam is located in the New Jersey Highlands physiographic province. The New Jersey Highlands extend across the State in a northeast/southwest direction from the border of New York to the Delaware River and includes the northwest portions of Hunterdon, Passaic, and Morris Counties and the southeastern parts of Warren and Sussex Counties. The province is part of the New England Physiographic Province and lies between the Appalachian Ridge and Valley Province to the northwest and the Piedmont Province to the southeast, See Fig 3.

The Highlands are characterized by rounded and flat-topped northeast/southwest ridges and mountains up to 1,400 ft high separated by narrow valleys. The orientation of the valleys are usually, but not always controlled by the underlying geologic structure.

Bedrock of the region is predominantly Precambrian gneisses, schists, and matasediments. Some sedimentary strata, typically sandstones, shales and conglomerate have been infolded and infaulted into the valley bottoms.

The regional geologic structure reflects the very old age of bedrock. A number of regional faults cross the area in a northeast southwest direction, including the Ramapo FAult; the more than 30 mile long fault/scarp forms the eastern border of the province. Faults control many of the river valley orientations. The relatively uniform slope of the mountain elevations, from northwest to southeast, is a direct result of the faulting. The entire area is part of the now dissected Schooley Peneplain.

The Pleistocene Age Wisconsin glacier covered all of the dam site area.

The glacier stripped most of the existing overburden and weathered rock and uncovered the numerous hard bedrock knobs and ridges seen throughout the province. Most of the side-slopes in the area are covered with heavy boulder tills (ground moraine), whereas glacial outwash and recent alluvium cover the valleys.

SECTION 3 VISUAL INSPECTION

Approximately one inch of water was flowing over the spillway crest at the time of our inspection which limited the extent of our observations. However, based on those parts of the dam and appurtenances we could observe it is our opinion the dam is in generally fair condition.

Several construction joints perpendicular to the axis of the spillway crest appeared open. Wooden flashboards approximately one foot high are attached to the spillway crest. Water was not flowing uniformly over the flashboards. The mid-portion of the spillway had less head flowing over boards.

The gatehouse contains five Coffin gate valve operators. The valves are well maintained and easily operated by one man.

The left concrete spillway sidewall has deteriorated upstream and the soil has eroded to a depth of about 2 ft behind the sidewall.

Spillway discharge goes under Route 206 through a concrete culvert into the Musconetcong River. To the right and parallel to the river is a portion of the old Morris Canal that feeds into the river further downstream.

The downstream face of the spillway has small spalled areas and vertical cracks at construction joints. Spalling and deterioration of the concrete has occurred at the discharge outlets of the gatehouse.

Deterioration of the concrete has occurred at the entrance to the culvert which crosses beneath Route 206. A small amount of debris has collected in the spillway discharge channel. The riprap at the left end of the spillway and the right side of the gatehouse is missing. Erosion and deterioration of concrete has occurred at the right downstream sidewall of the culvert under Route 206 and erosion has occurred at the left downstream sidewall.

A section of the sidewalk above the dam has depressed about 2 inches. The iron fence along Route 206 has rusted and appears to have at one time stopped a vehicle from falling into the discharge channel.

The earth slopes surrounding the lake are relatively flat and no adverse conditions were observed. Our Visual Inspection Check List is given in Appendix 2 and Photographs are given in Appendix 3.

SECTION 4 OPERATIONAL PROCEDURES

Operation and maintenance of the dam is the responsibility of the N.J.D.E.P. Division of Parks and Forestry. There are four 3 ft by 5 ft vertical lift sluice gates and a control valve on a 36-in-dia pipe. The operator stands are manufactured by Coffin of Boston. They are well maintained and in good condition. They can be operated by one man. The 36-in-dia pipe provides a constant flow of water to the Morris Canal which is used by the Stan Hope Fire Department for fire protection. The sluice gates are seldom opened except in the winter when the left gate is maintained open slightly to prevent ice forming and permits water level measurements.

SECTION 5 HYDRAULIC/HYDROLOGIC

No information is available concerning original design data for Lake Musconetcong Dam. The results of studies made in 1931 subsequent to its construction have been given in Appendix 1.

The hydraulic/hydrologic evaluation is based on a Spillway Design Flood (SDF) equal to the full Probable Maximum Flood (PMF) chosen in accordance with the evaluation guideslines for dams classified as high hazard and Intermediate in size. Hydrologic design data for this dam is not available. The PMF has been determined by developing a synthetic hydrograph based on the maximum probable precipitation of 22.4 inches (200 square mile - 24 hour). Hydrologic computations are presented in Appendix 4. The PMF peak inflow determined for the subject watershed is 6140 cfs.

The capacity of the spillway is 3460 cfs which is less than SDF.

Flood routing for the PMF (with the gates closed) indicates the dam will overtop by 1.8 ft. We estimate with gates closed the dam can adequately pass 71% of the PMF.

The downstream potential damage center is a well traveled highway (Route 206) across the crest of the dam and nearby residential buildings, which are located downstream of the dam. Based on our visual inspection of the immediately downstream topography and knowledge of the dam it is our opinion that dam failure resulting from overtopping would cause excessive property damage and could potentially cause more than a few deaths.

Drawdown of lake below spillway crest has been evaluated considering the four 3 ft x 5 ft sluice gates and the 36-in-dia discharge pipe function properly and are utilized for this purpose. Our calculations indicate the lake level could be lowered 5 ft in approximately 1 day and 9 ft in about 5 days.

SECTION 6 STRUCTURAL STABILITY

There is no available information concerning the dam foundation material. However, it is our opinion based primarily upon our visual observations, and evaluation of the type and conditions of the dam, that it is stable under static loading and is likely to have conventional safety margins.

Lake Musconetcong Dam is located in Seismic Zone 1 of the Seismic Zone Map of Contiguous States. In its present condition the degree of structural stability is assumed to be adequate with respect to both static and seismic loadings.

SECTION 7 ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Assessment

Lake Musconetcong is 52 years old and in fair overall condition. There is spalling, deterioration, and cracking of concrete at different locations on the dam, spillway and outlet works that should be repaired. The spillway capacity as determined by CE Screening criteria is inadequate. We estimate the dam can adequately pass 71% of the PMF.

7.2 Recommendations/Remedial Measures

We recommend the following remedial measures:

1. Trashracks should be installed at the gatehouse intake. A means of hoisting the trashrack into and out of its channels should also be provided. This should be done soon.

2. The crack in the joint of the downstream face of the spillway should be repaired. This should be done soon.

3. An inspection of the concrete of the spillway discharge channel at the upstream toe of the dam should be performed when no water is flowing over the spillway. This should be done soon.

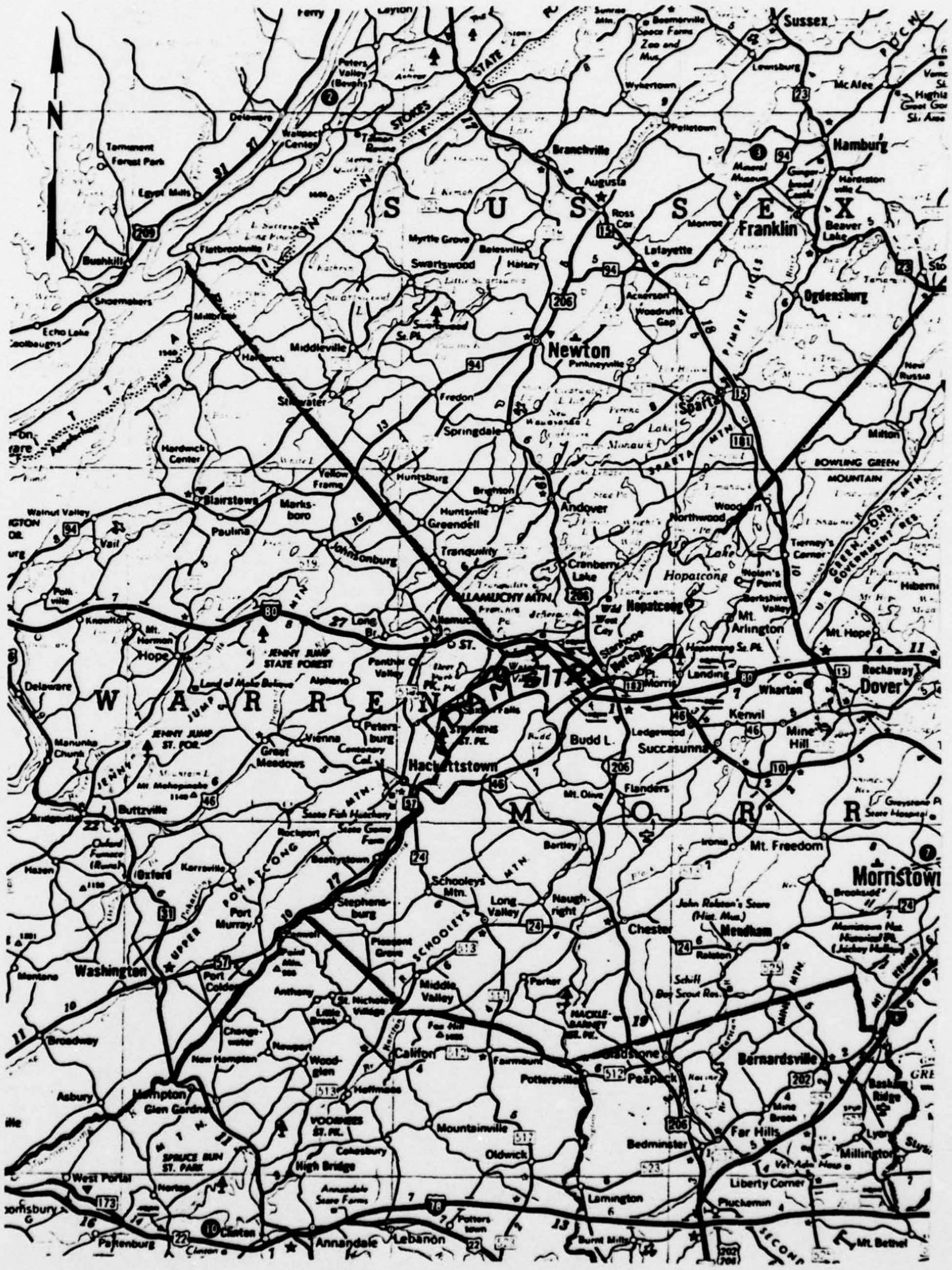
4. The engineering properties of the dam foundation material should be investigated by means of borings and tests, and stability analysis made using present day methods to confirm our assumptions concerning the structural stability of the dam and appurtenances under different stress conditions. This should be done soon.

5. Spalled and eroded areas on the downstream face of the spillway, the sidewalls, the discharge outlet structure, and the upstream end of the culvert under Route 206 should be repaired. This should be done in the near future.

6. The iron picket fence along Route 206 should be cleaned and painted and an evaluation made of its ability to stop a fast moving heavy vehicle from accidently falling into the spillway discharge channel. This hould be done in the near future.

7. The depression of the concrete sidewalk along Route 206 should be investigated and repaired. This should be done in the future.

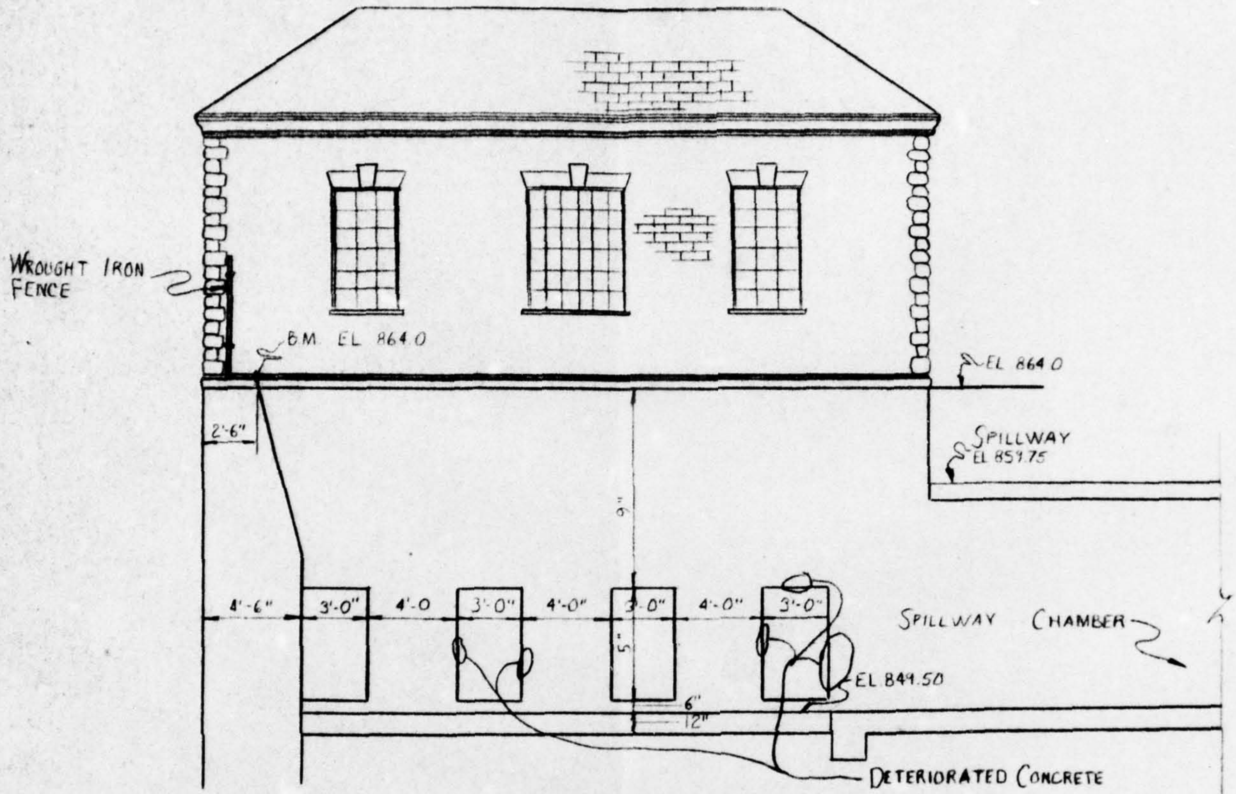
8. The spillway capacity as determined by CE Screening criteria is inadequate. The actual capacity of the SDF and the spillway should be determined using more precise and sophisticated methods and procedures. The need for and type of mitigating measures should be determined. Around the clock surveillance during periods of unusually heavy precipitation should be provided, and a warning system established. This should be done in the near future.



1in ≈ 5.2 mi

REGIONAL VICINITY MAP
LAKE MUSCONETCONG DAM

Fig. 1



SECTION A-A

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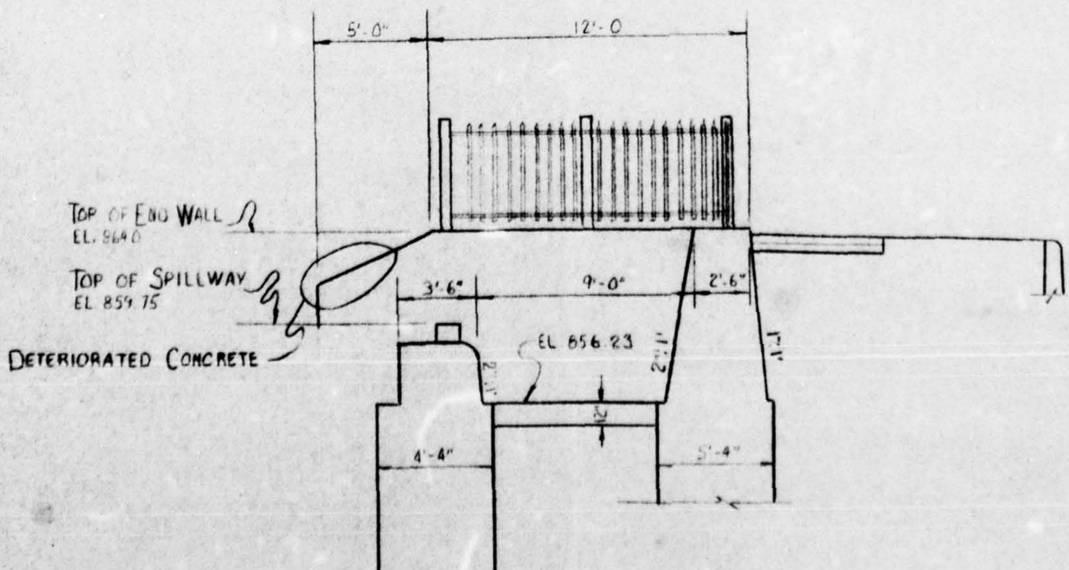


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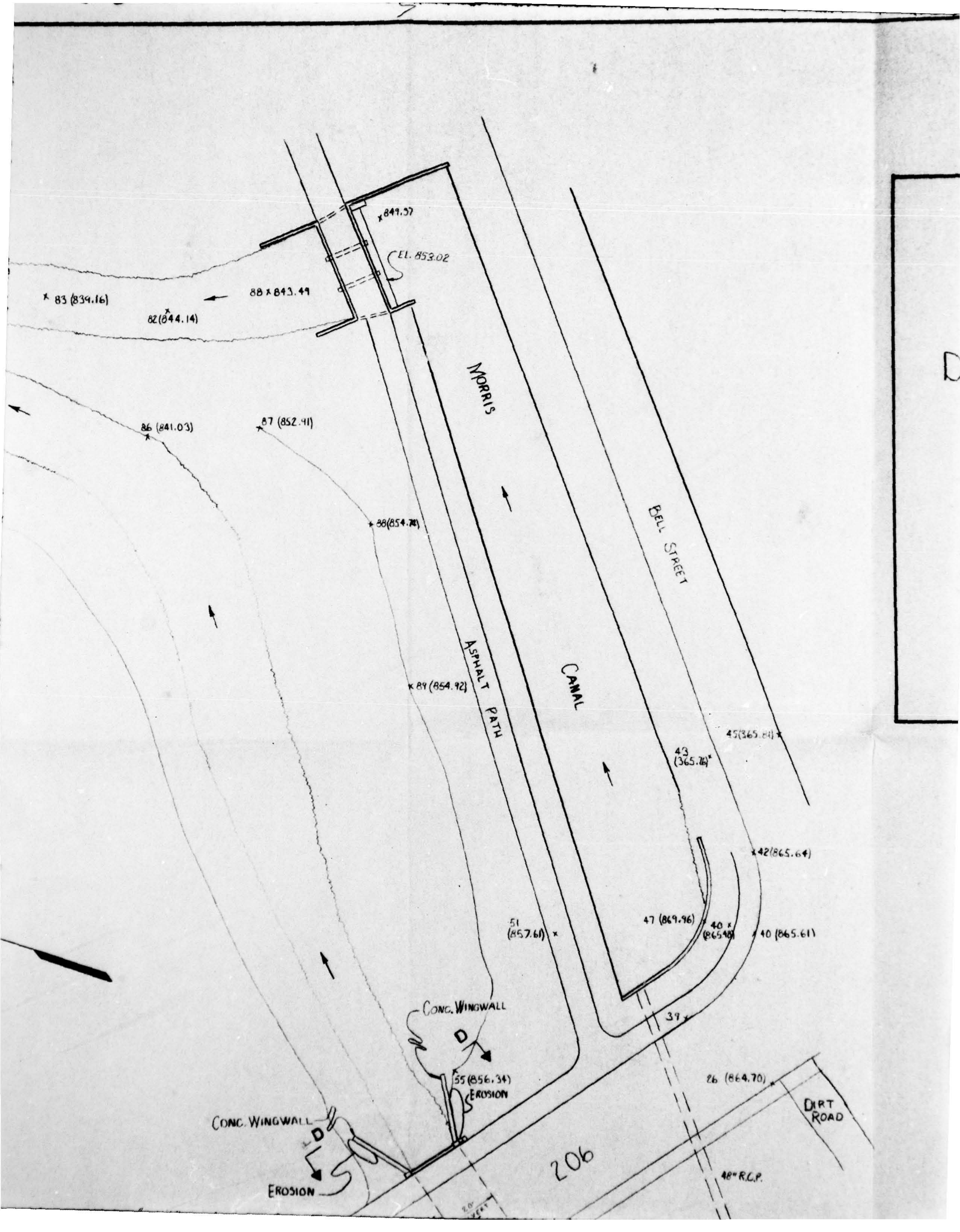

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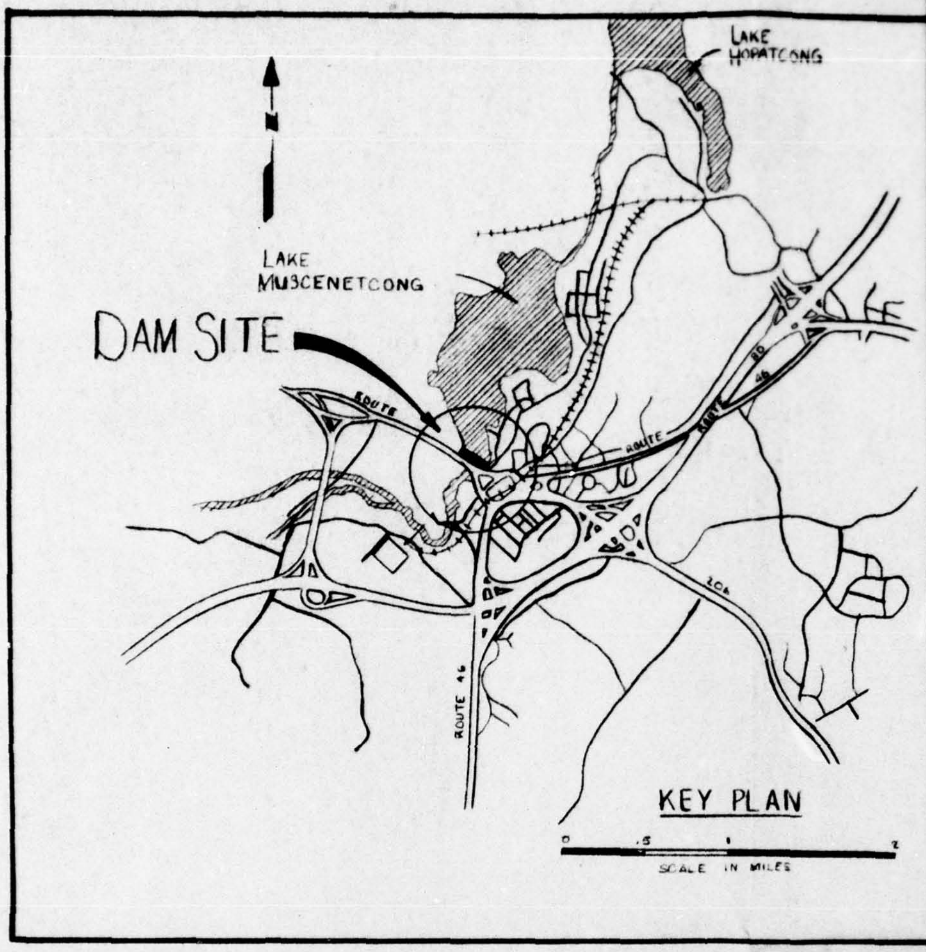
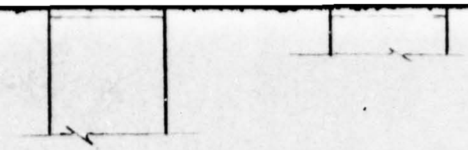
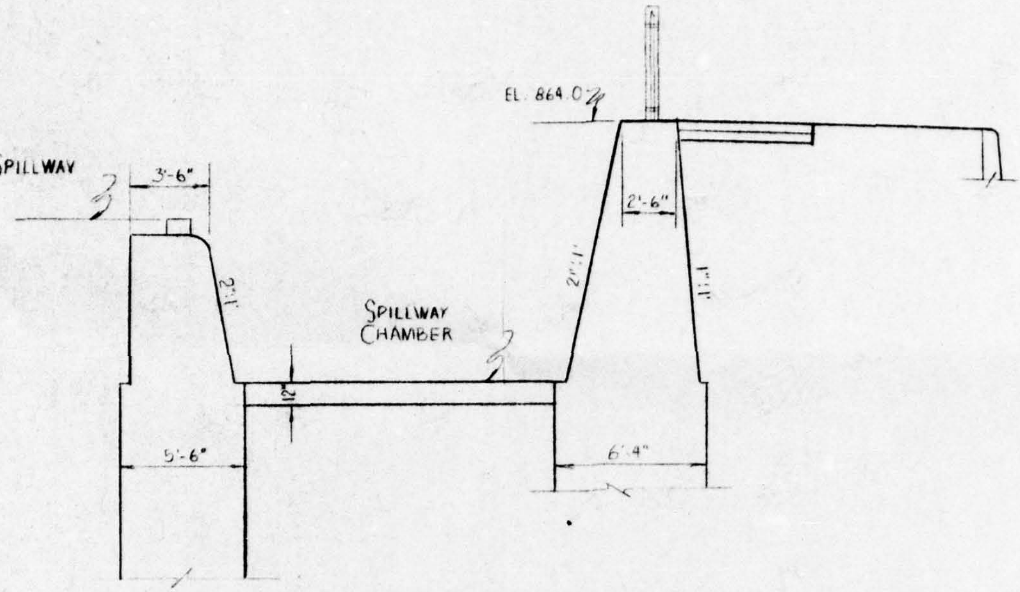
83 (839.16)
82 (844.14)
MORRIS
86 (841.03)
87 (852.41)
88 (854.78)
BELL STREET
ASPHALT PATH
89 (854.92)
CANAL
45 (365.81)
43
(365.76)
42 (865.64)
51
(857.61)
47 (869.96)
40
(865.48)
40 (865.61)
39
CONC. WINGWALL
D
55 (856.34)
EROSION
26 (864.70)
DIRT
ROAD
CONC. WINGWALL
D
206
EROSION
48" R.C.P.



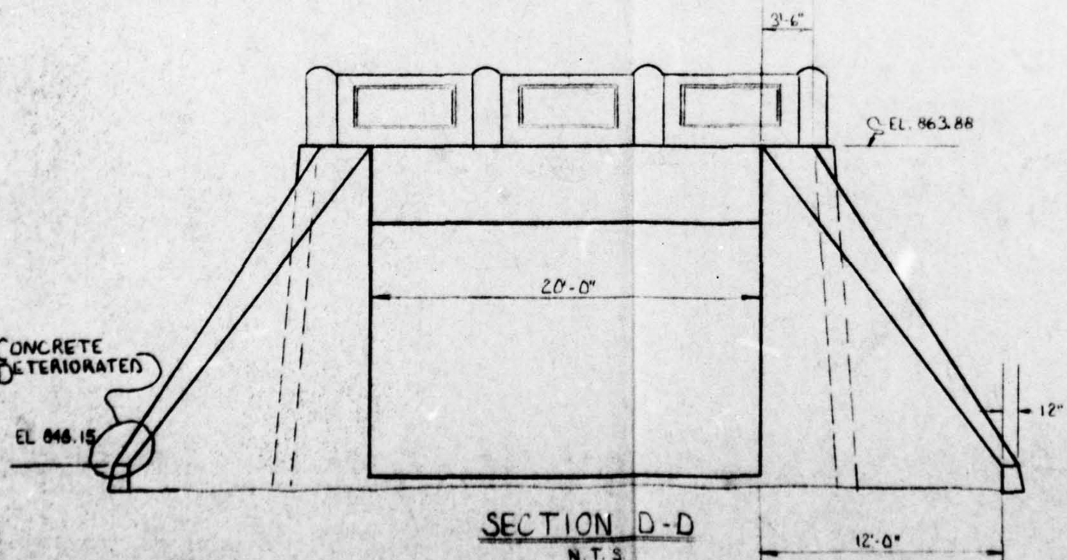
LAKE HOPATCONG
N
LAKE MUSCENETCONG
DAM SITE
ROUTE
ROUTE
ROUTE 46
80
46
206
ROUTE 46
KEY PLAN
0 .5 1 2
SCALE IN MILES



SECTION B-B
SCALE: 1"= 6'

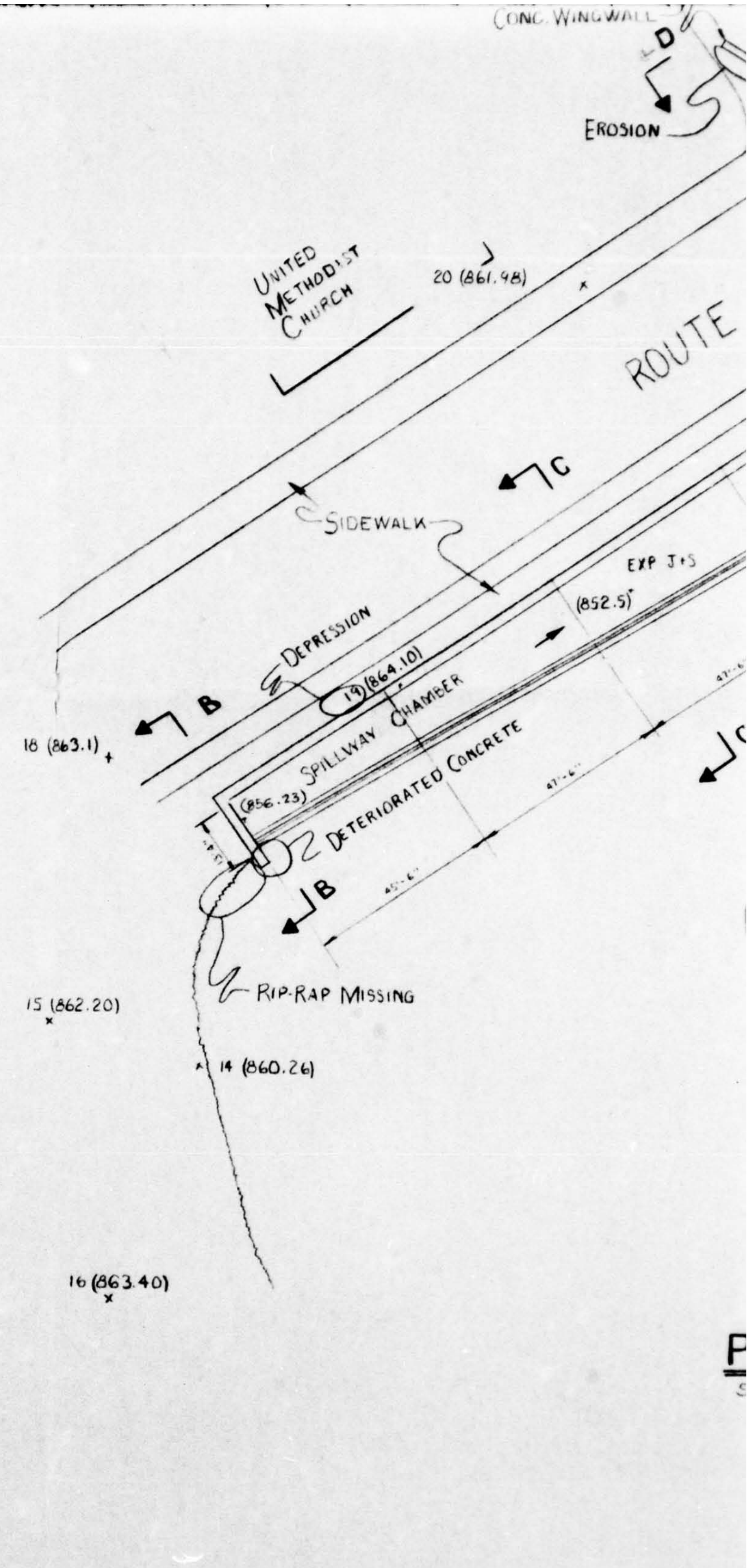


SECTION C-C
SCALE: 1"=6'

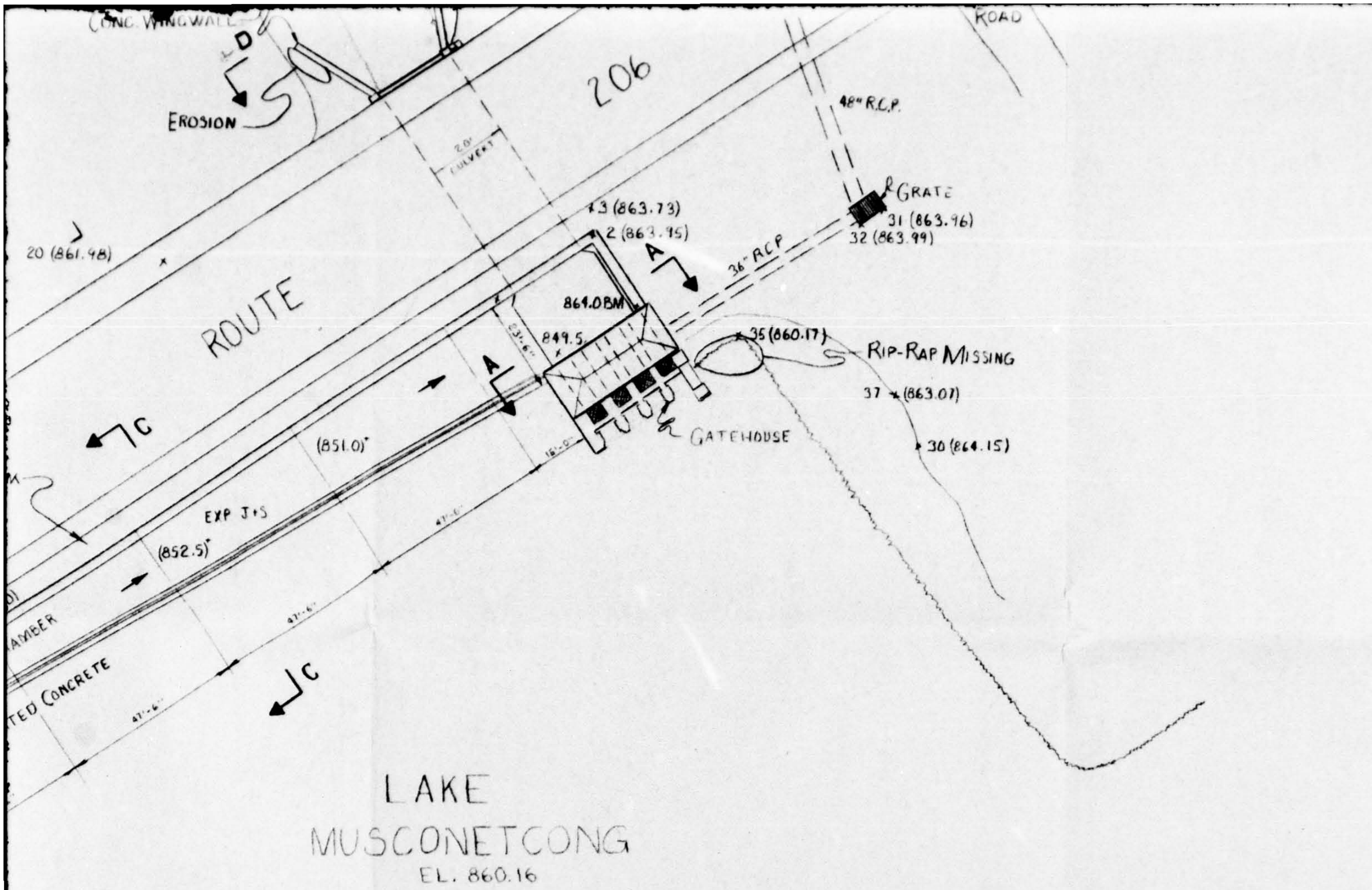


SECTION D-D
N. T. S.

5



CONC. WINGWALL
D
EROSION
UNITED METHODIST CHURCH
20 (861.98)
ROUTE
C
SIDEWALK
EXP J+S
(852.5)
DEPRESSION
19 (864.10)
SPILLWAY CHAMBER
B
18 (863.1)
DETERIORATED CONCRETE
(856.23)
B
RIP-RAP MISSING
15 (862.20)
14 (860.26)
16 (863.40)



PLAN

SCALE: 1" = 30'

NOTE:

THE ELEVATIONS SHOWN WERE OBTA
THEY ARE APPROXIMATE. THE BENCH
WALL OF THE SPILLWAY CHAMBER WAS
CANAL & BANKING CO. DOVER N.J. OFF
SURFACE AND WATER LEVEL ARE INF

ELEVATIONS SHOWN WERE OBTAINED USING A SURVEYOR'S TRANSIT AND LEVEL.
RE APPROXIMATE. THE BENCHMARK ELEVATION OF 864.0 ON THE NORTH
THE SPILLWAY CHAMBER WAS USED AS INDICATED ON DWGS. OF THE MORRIS
& BANKING CO. DOVER N.J. OFFICE. JULY 1, 1925 INFORMATION SHOWN BELOW GROUND
E AND WATER LEVEL ARE INFERRED ON THE BASIS OF SAID DWGS.

DATE	DESCRIPTION	NO.
REVISIONS		

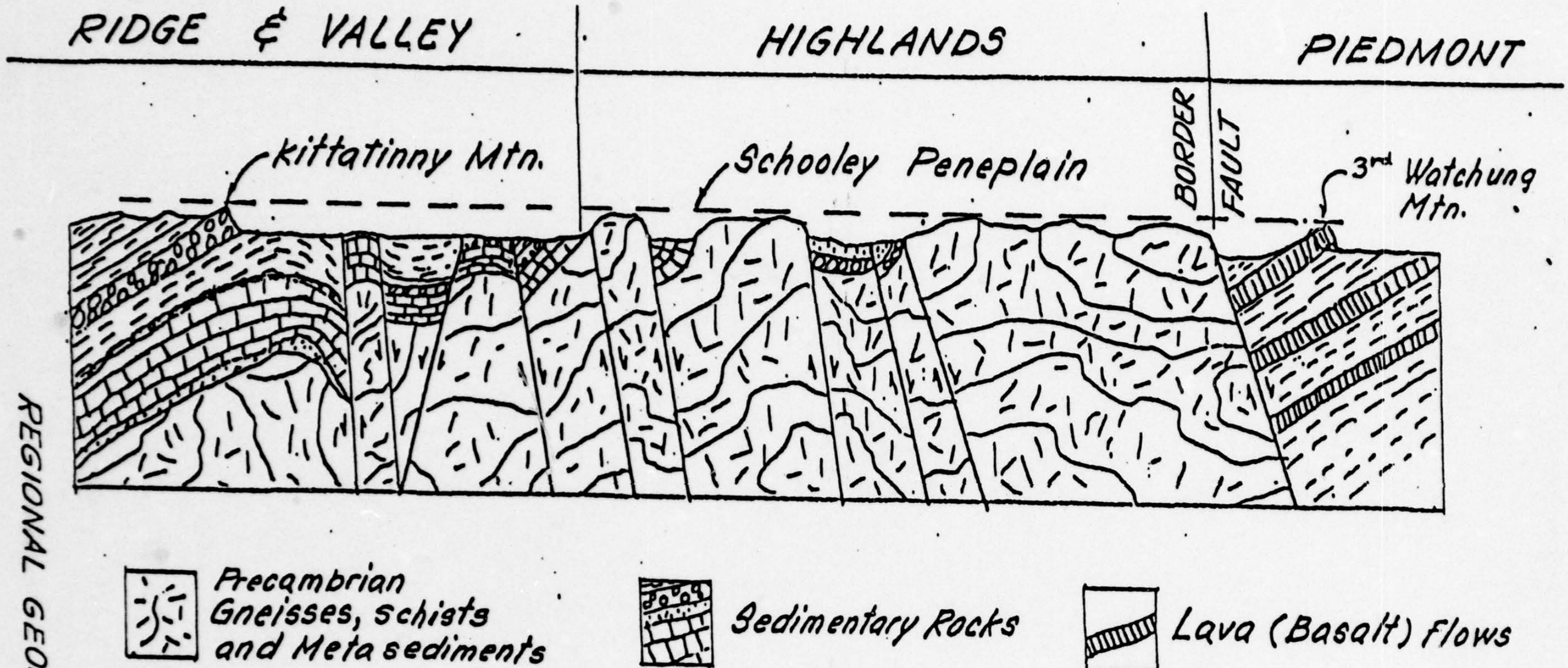
PROJECT

PHASE I
INSPECTION & EVALUATION of NEW JERSEY DAMS

DRAWING TITLE

LAKE MUSCONETCONG DAM
JANUARY 1979
FED. I.D. NO. NJ 00328

JOB NO.	J-783B	DRAWING NO.
DATE	26 JAN. 1979	FIG 2
SCALE	AS NOTED	
DRN. BY	R.Z.	
CHKD. BY	D.J.L.	OF · SHEETS



Schematic Cross-Section of
Ridge & Valley
Physiographic Province
(After Wolfe, 1977)

REGIONAL GEOLOGIC FEATURES

Fig. 3

APPENDIX 1

HYDROLOGIC DATA

LAKE MUSCONETCONG DAM

CEIV D

JN 1 - 193

Cornelius C. Vermeule

CONSULTING ENGINEER

38 PARK ROW

NEW YC

May 29th, 1931.

Mr. Howard [illegible] Critchlow, Chief,
Division of Applications,
State Water Policy Commission,
[illegible] West State Street,
Trenton, N. J.

Dear Mr. Critchlow:

Mr. Sherman, of the Newark Office of your Commission, has suggested that I get in touch with you regarding the spillway capacity at Lake Musconetcong after the proposed increased height of 2 ft.

You will note that the spillway will take care of [illegible] cu.ft. per second per square mile of catchment, either with the gates open or gates closed. I do not believe that the discharge will ever reach this figure. For one hundred years floods at this point were handled through a small gate and through the canal lock. As you know, no spillway existed until 1926.

Due to the pressure of work at this office, it will be impossible for me to go to Trenton within the next week. I am therefore enclosing a memorandum concerning the spillway discharge at this point. I have also sent a copy to Mr. Sherman. I shall be very glad to give you any further information which you may require.

Very truly yours,

Cornelius C. Vermeule

Cornelius C. Vermeule, Jr.

[illegible]

Enclosure.

Memorandum Concerning Spillway at Lake Musconetcong.

This has been computed according to the requirements of the Water Policy Commission, which are stated to be 100 cu.ft. per second per square mile of catchment, which for the 30.3 square miles would call for 3,030 cu.ft. per second. The spillway is 203 ft. long. Co-efficient has been taken at 3.33 in the formula - Q = 3.33 x the square root of the cube of H.

With the gates closed, the above discharge would call for a height on the spillway of 2.72 ft. and with the gates open 2.15 ft.

There are four sluice gates, each 3 x 5 ft. The elevation of the raised spillway is 861.0, and at the center of the gates 852.5. With 0.5 ft. depth on the spillway, the head on the gates is 9 ft. With C = 0.62, the discharge of the four gates is estimated at 896.5 cu.ft. per second.

With the gates open therefore, the height on the spillway required for the above maximum discharge will be as before stated, 2.15 ft.

The net head on the spillway under flood conditions will be as follows:

With the sluice gates closed and Q = 3,030 cu.ft. per second, the water will rise in the channel below the spillway and at the gate house to elevation 860.3. At the far end of the spillway the height in the channel will be 862.5.

The water on the spillway will be 863.72. The net head or difference in water level above and below the spillway will be at the gate house 3.42 ft. and at the far end of the spillway 0.92 ft.

With the sluice gates open, the discharge over the spillway will be 2,133.8 cu.ft. per second. The elevation of the water below the spillway at the gate house will be 859.45, and at the far end of the spillway 861.95. The net head on the dam under these conditions will be at the gate house 3.7 ft., and at the far end of the spillway 1.2 ft.

It should be noted from the above figure that the maximum pressure on the dam will occur when the lake is just level with the spillway.

Although the spillway will amply care for the above amount of water, it is far beyond what can ever occur. The discharge from Lake Hopatcong was carefully estimated when the dam was built, and it was found with an inflow to the lake of 115 cu.ft. per second per square mile, owing to the absorption of water by the lake in reaching a given height on the spillway, the discharge over the spillway could not exceed 1260 cu.ft. per second. This maximum would occur at least twelve hours later than the maximum from the lower catchment of 4.9 square miles, and it is estimated from these figures that the maximum discharge over the dam at Lake Musconetcong cannot actually exceed 14[illegible] cu.ft. per second. This will cause a rise of 1.[illegible]4 ft. on the spillway with the gates closed, or [illegible].53 ft. with the gates open.

The old canal dam at Saxton Falls stood for nearly one hundred years and could never have remained there had the discharge at that point exceeded 60 cu. ft. per second per square mile.

Cornelius C. Vermeule
CONSULTING ENGINEER
38 PARK ROW
NEW YORK

June 4th, 1931.

Mr. Howard T. Critchlow,
Division Engineer,
State Water Policy Commission,
28 West State Street,
Trenton, N. J.

Dear Mr. Critchlow:

Replying to your favor of the 2nd inst., the spillway was computed on an average co-efficient of 3.33 after we had found that the co-efficient was so close to that that we could use the tables based on the Francis formula. However, I will give you the conditions more in detail as follows:

[illegible] 1930 [illegible] 100

The water elevations below the spillway are, at the gate house 860.3, at the middle point of spillway 861.07, and at the south end 862.8. The first half of the spillway from the gate house is practically a free discharge, for the reason that the above elevations are not to stillwater as required in the submerged weir formula, but are taken where the velocity is very high, it being impossible to get the figures for still-water. Consequently for the first 101.[illegible] ft. the co-efficient is taken at 3.485. This is from experiments, series 4 of the Cornell Experiments, page [illegible], W.S. & I. paper No. 200.

For the remainder of the spillway I have used Herschel's formula for drowned weirs, see Transactions, American Society C.E., May 1886, page 189. In this paper he gives certain corrections for the head called "a", and after this correction is made, the discharge is computed as if in free air.

[illegible] Paper #200 p. 131

The following are the values of H and h, H being the same throughout and h varying.

H = [illegible].72. @ middle point, h = 0.07. At 50.75 ft. south h = [illegible].

[illegible]

At south end h = 1.80.

From the above, the value of q for 1 ft. of spillway is worked out as follows:

Middle of spillway, q = 15.61
At 50.75 ft. south of middle, q = 14.25
At south end of spillway, Q = 11.36

From the above we obtain the following discharges over several sections of the spillway.

First half from gate house:
q = 15.61 x 101.5 = 1,584 c.f.s.

For next quarter of spillway:
q = 14.93 x 50.75 = 758 c.f.s.

For the south quarter of spillway:
q = 12.805 x 50.75 = 650 c.f.s.

Total discharge 2,992 c.f.s.

This corresponds to a co-efficient of 3.29. However, it does not take into account the fact already stated, that h is not taken to stillwater, and that unquestionably the high velocity below the spillway will increase it. For this reason I consider it conservative to use 3.33 throughout. However, if the above 3.29 is used, the difference in head is trifling.

Taking up next the question you raised as to the discharge from Lake Hopatcong, I did consider present day conditions. This was thoroughly worked out, as I previously stated, when the spillway and gates at Lake Hopatcong were designed. There are four gates there, measuring 3 ft. x 5 ft., and with the water level with the spillway, the head on the center of the gates is [illegible] ft. With a co-efficient of 0.62, this gives a discharge of 229.7 c.f.s. for each gate, or 918 cu.f.s. for four gates. The maximum conditions were found to be with all gates open and 1 ft. on the spillway, giving a total discharge as previously stated, of 1260 c.f.s., the spillway being [illegible] ft. long.

The lake contains 2,443 acres and the total

catchment including the lake is 2[illegible].4 sq.miles. We made several computations but I think a single one will show the impossibility of the maximum flow ever reaching above 1260 c.f.s. The inflow is based on the Pequannock in October, 1903, and at that point it began with no discharge. After thirty-three hours it reached 6,000 c.f.s. and at the end of sixty-six hours it had fallen to 1800 c.f.s. Considering the retarding influence of the lake, we may use these figures and taking forty per cent of the above for Lake Hopatcong, which gives an inflow at the end of thirty-three hours of 2400 c.f.s., and at the end of sixty-six hours of 720 c.f.s. At these rates the total volume of inflow would be as follows:

First 33 hours	142,560,000 cu.ft.
Next 33 hours	185,328,000 " "
Total for 66 hours	327,888,000 cu.ft.

If we assume that the gates were open at the beginning of the flood, which would be the condition producing a maximum, we should have the following outflow during the first thirty-three hours, the rise on the spillway being 6 inches.

Through the gates	109,153,440 cu.ft.
Stored in Lake 6 inches	53,208,540 " "
Discharge over spillway	7,009,200 " "
Total Discharge	169,371,180 cu.ft.

For the next thirty-three hours the discharge would continue at the same rate through the gates, but the lake would rise 6 inches further so that the discharge over the spillway would be due to a head of 1 ft. This would dispose of the remainder of the flood as follows:

Discharge through gates	109,153,440 cu.ft.
Stored in Lake 6 inches	53,208,540 " "
Discharge over spillway	26,730,000 " "
	189,191,980 cu.ft.

During the sixty-six hours therefore, the inflow would be 327,888,000 cu.ft. and the offset 358,563,160 cu.ft. The

difference is unimportant I have not recomputed it to make the balance exact.

For the above flood therefore, the maximum discharge occuring at the end of sixty-six hours would be:

Through the gates		918 c.f.s.
Over spillway		342 c.f.s.
	Total	1260 c.f.s.

The only use made of the Canal data was in computing the volume of the flood, made up of the amount discharged through the gates plus a very large accumulation in the lake due to the time it was drawn down. These calculations fully demonstrate that there had been no flood at Lake Hopatcong so severe as the one on the Pequannock, upon which we have based the above estimate. The rainfall at Lake Hopatcong is materially less than along the Pequannock.

Perhaps the following presentation will demonstrate more absolutely the impossibility of a discharge from Lake Hopatcong reaching [illegible] second feet per square mile, or 2540 second feet.

First let us assume that the gates are open, discharging 918.8 second feet. It would then be necessary that the discharge over the spillway should reach 1621.2 second feet to give the above maximum. The spillway is 100 ft. long and to reach this discharge H must equal 2.87 on the spillway. This would require that the lake should fill up 2.87 ft. in the sixty-six hours, and this would absorb 305,416,800 cu.ft.

The discharge over the spillway during 66 hrs. at 810.6 c.f.s. would =	193,881,600 " "
The discharge through the gates for the same period would amount to	218,306,880 " "
This would give a total for 66 hrs. of	717,605,280 cu.ft.

This is of course against the actual inflow as computed before 327,888,000 cu.ft.

It will be seen to have been impossible for the lake to ever rise to a height that would give 2.87 ft. on the spillway.

Mr. Howard T. Critchlow June 4th, 1931.

Next let us assume that the gates remained closed. Then in order to reach a discharge of 2540 second feet over the spillway we must have a height above the spillway of 3.87 ft., the lake being filled up to a corresponding height. We should therefore have for the sixty-six hours the following:

3.87 ft. on the lake	411,833,790 cu.ft.
Discharge over spillway, 66 hrs.@ 1270 second ft.	301,752,000. " "
Total	713,585,790 cu.ft.

This is again considerably more than double the actual amount of the run-off based upon the Pequannock record of 1903.

Concerning the discharge at Saxton Falls in 1903, a careful survey of conditions there as they were before we rebuilt the dam, shows that the water rose on the dam to elevation 95.5. This gave the following spillway conditions.

L = 111.2	
H = 4.4	
Discharge	3,410.5
L = 54.	
H = 2.0	
Discharge	320.3
L = 20.	
H = 1.7	
Discharge	147.6

Total Spillway Discharge 3,878.4

In addition the gate measured 8 ft. x 12.3 ft., or 98.4 sq.ft. with an effective head of 4 ft. after allowance for back-water. This gives a gate discharge of 976.2.

Total Discharge 4,854.6

At this time there was a steady discharge through the gates at Lake Hopatcong of 545 second feet, which deducted from the above, gives 4309.6 second ft. discharge from the lower 42.6 square miles of catchment, which comes to 101.1 second feet per square mile.

This is given to show that whereas 100 second feet per square mile applies to the free catchment, it does not apply to the whole catchment including Lake Hopatcong. You will observe that if 4,854.6 second feet at Saxton Falls is spread over the whole 68 square miles of catchment at that point, it comes to 71.4 second feet per square mile. As previously stated, our experience at Saxton Falls has demonstrated fully that if there had been a discharge there at the rate of 100 second feet per square mile, or 6800 second ft., it would have torn out the abutments of the dam and the canal bank below the dam, due to the rush of water through the lock over the top of the lock, gates and the walls.

Hoping that I have made the above clear, I am

Very truly yours,

Cornelius C. Vermeule, Jr.

CCV/D.

APPENDIX 2

CHECK LIST

VISUAL INSPECTION

LAKE MUSCONETCONG DAM

CHECK LIST
VISUAL INSPECTION
Phase I

NAME DAM Lake Musconetcong COUNTY Morris STATE New Jersey COORDINATORS N.J. DEP

DATE(s) INSPECTION See Below WEATHER Overcast TEMPERATURE 45° F

POOL ELEVATION AT TIME OF INSPECTION El. 860.16 M.S.L. TAILWATER AT TIME OF INSPECTION El. 851± M.S.L.

INSPECTION PERSONNEL:

J. Richards 12/7/78	P. Yu 12/14/78	
D. Leary 12/7/78	J. Gurkovich 12/14/78	
J. Rizzo 12/14/78		

James Richards RECORDER

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Dead branches, wood, bottles, paper, large chunk (2 ft X 3 ft X 1.5 ft) of styrofoam. A rock spillway 600' downstream.	Debris, etc. should be removed.
SLOPES	Varies from vertical stone wall to earth slopes of 1:1 to 1(V) to 3(H). Slopes appear satisfactory.	
APPROXIMATE NO. OF HOMES AND POPULATION	Church, church school, & in excess of 20 homes located downstream. Excess of 200 people.	Warning alarm system & emergency gate should be installed.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEE PAGE ON LEAKAGE	None observed	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS (Direction: looking d/s)	At left end of spillway, erosion of over 2 ft in depth and width of 15 ft and length of 25 ft.	Eroded area should be suitably repaired.
DRAINS		
WATER PASSAGES	Generally clear, a few pieces of debris. 150 gpm est coming out of left sluice gate.	Debris should be removed.
FOUNDATION	Not observable.	

CONCRETE/MASONRY
(SPILLWAY AREA)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES (Direction: looking d/s)	Left end of spillway concrete surface cracked over majority of area and spalled to depth of 6 inches. Right end of spillway concrete spalled to depth of 4 inches.	Cracked and spalled concrete should be repaired.
STRUCTURAL CRACKING	Water flowing over spillway at time of investigation. None observed.	
VERTICAL AND HORIZONTAL ALIGNMENT	Vertical alignment of flash boards appears off by 2 inches, water flowing 2 inches higher on left & right of center portion of spillway.	
MONOLITH JOINTS	Appear satisfactory.	
CONSTRUCTION JOINTS	Several joints appear open.	Joint should be repaired.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT (Direction: looking d/s)	Downstream culvert concrete spalled on left & right entrance walls of culvert (2 in X 1 ft X 8 ft and 4 in X 8 in X 1.5 ft, respectively).	Spalled concrete areas should be repaired.
INTAKE STRUCTURE	Appears satisfactory.	
OUTLET STRUCTURE	Concrete spalled on two outlet chambers, left most outlet chamber spalled on three sides and second to right spalled on two opposite sides.	Spalled concrete should be repaired.
OUTLET CHANNEL (Direction: looking d/s)	Appears satisfactory.	
EMERGENCY GATE	None observed.	Alarm system & emergency gate should be constructed.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARK OR RECOMMENDATIONS
SLOPES	Slopes vary from vertical stone walls in front of homes to 1(V) to 10 (H) along soil slopes. Several eroded areas up to 4 in deep and in excess of 20 ft in length observed. In excess of 5 trees overhanging slopes and soil is eroded beneath.	Eroded areas should be suitably repaired.
SEDIMENTATION	Bottles, paper, cans in reservoir. Amount of sedimentation not determined. Non observed.	Debris should be removed.

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SPILLWAY CREST	Construction joints opened in excess of 1 in downstream. Flash boards appear 12 in in height above crest. Alignment appears satisfactory.	Joints should be suitably repaired.
APPROACH CHANNEL	Appears satisfactory.	
DISCHARGE CHANNEL	Wood and cans in channel.	Debris should be removed.
BRIDGE AND PIERS		

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Concrete spalled in more than 1 area and spalled to depths of ¼ in to 1 in.	Spalled concrete areas should be suitably repaired.
APPROACH CHANNEL	Wood, styrofoam cups, baseball, leaves and cans in channel.	Debris should be removed.
DISCHARGE CHANNEL	Connects to ungated spillway.	
BRIDGE AND PIERS	A concrete conduit runs under roadway downstream.	
GATES AND OPERATION EQUIPMENT	4 Coffin manufactured valves stems with crank operators in gatehouse. Concrete below base plates cracked on all four operators.	Cracks should be checked for depth and repaired.

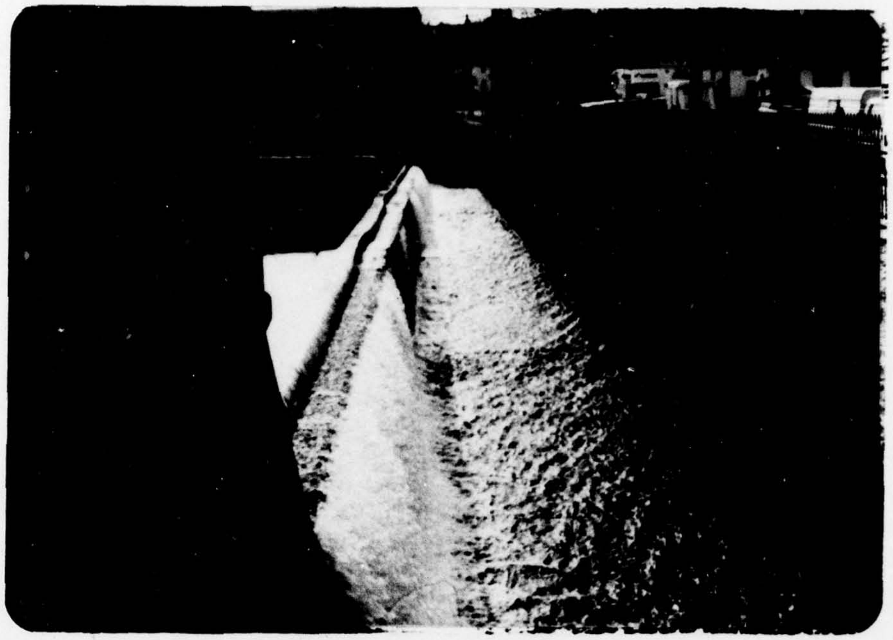
APPENDIX 3

PHOTOGRAPHS

LAKE MUSCONETCONG DAM

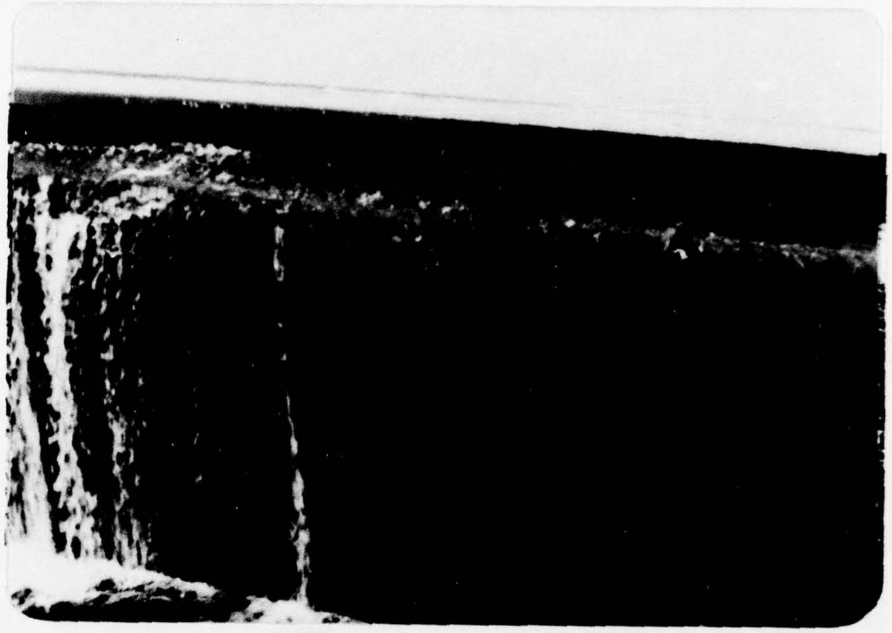
Dam (Route 206). 7 December 1978
Looking downstream.

Spillway. Looking west. 7 December 1978

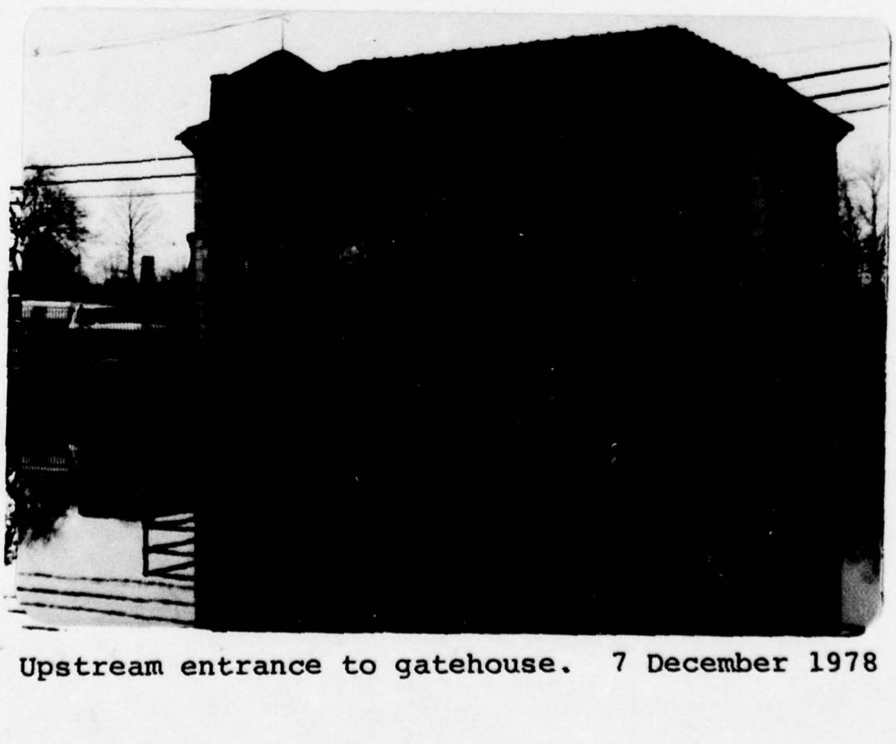


Spillway. Looking east from gatehouse. 7 December 1978

Debris in spillway. 7 December 1978



Spalled and cracked concrete and timber riser on crest of spillway. 7 December 1978

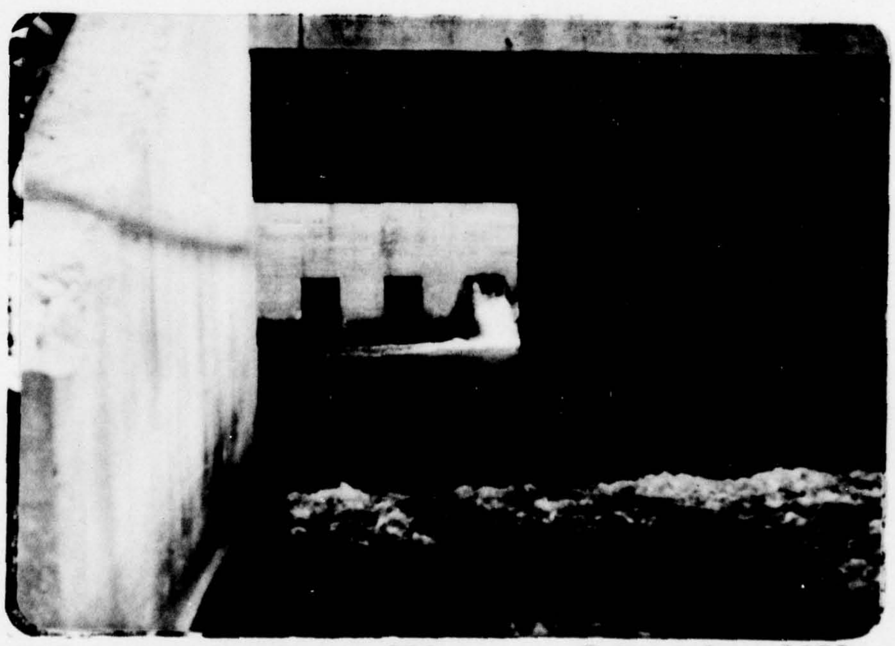


Upstream entrance to gatehouse. 7 December 1978

Deteriorated riprap at right abutment. 7 December 1978

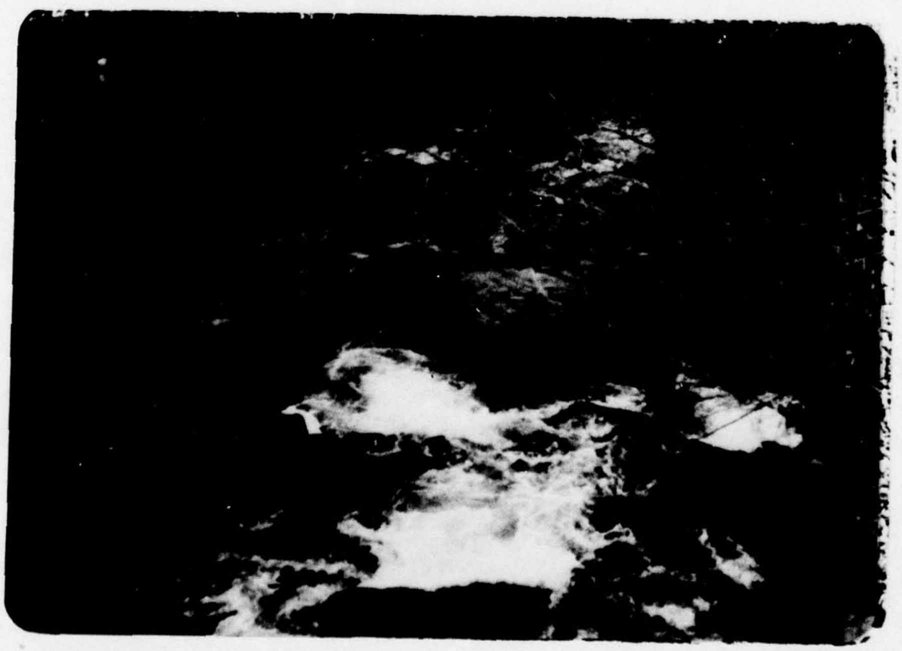
Discharge from gatehouse into spillway channel. Note deteriorated concrete. 7 December 1978

Spalled concrete at upstream side of culvert under Route 206. 7 December 1978

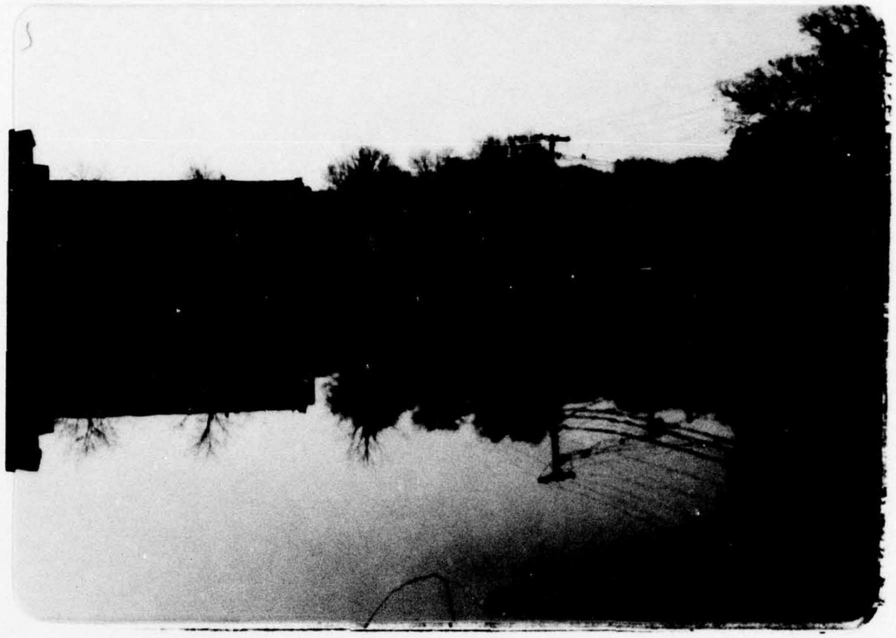


Culvert under Route 206. Looking upstream. 7 December 1978

Erosion and spalled concrete at right sidewall below culvert under Route 206. 7 December 1978



Discharge channel. Looking downstream. 7 December 1978



Left abutment area. Looking south. 7 December 1978

Spalled concrete at end wall of spillway channel. Note absence of riprap. 7 December 1978

APPENDIX 4

HYDROLOGIC COMPUTATIONS

LAKE MUSCONETCONG DAM

LANGAN ENGINEERING ASSOCIATES, INC.

HYDROLOGIC COMPUTATIONS

LAKE MUSCONETCONG DAM

Location : Morris - Sussex County, N.J.

Drainage Area : 30.3 sq. mi – [25.4 sq. mi to Lake Hopatcong
4.9 sq. mi to Lake Musconetcong proper

Lake Area : 307 Acres

Classification : Size – Intermediate
Hazard – High

Spillway Design Flood

Based on available information, it is understand that the spillway and gates have been designed on the basis of the flood of Oct. 1903. In accordance with the evaluation criteria, PMF should be used.

COMPUTE PMF

1. Dam located in Zone 6
PMP = 22.4 inches (200 sq. mi in 24 hrs.)
2. PMF must be adjusted for basin size

Duration - hr	% Factor (for 10 sq. mi)	Reduction Factor*
0-6	112	
0-12	123	0.80
0-24	132	
0-48	142	

* p. 62 "D.S.D"

BY PJY DATE 2-1-79 Lake Musconetcong Dam JOB NO. J-783B
CKD [illegible] DATE 3.29.79 SHEET NO. 1 OF 12

3. Methodology

a) PMF be calculated using HEC-1 with Snyder Coefficients $C_t = 3.70$ and $C_p = 0.58$ recommended the Army Corp of Engineers.

b) Within Lake Musconetcong's drainage basin lies Lake Hopatcong. The outflow hydrograph from Lake Hopatcong is combined with the local inflow from the remaining drainage area to develop the inflow hydrograph for Lake Musconetcong and subsequent routing. (See schematic network next pg.)

UNIT HYDROGRAPH

Corp of Engineers has indicated that Snyder Method be used to develop local inflow for Lake Musconetcong's intermediate drainage area.

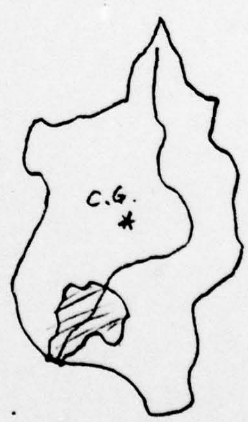
Snyder Lag time:

$t_p = C_t (L \cdot L_{ca})^{0.3}$

from drainage area

$L = 20350 \text{ ft} \doteq 3.85 \text{ mi}$

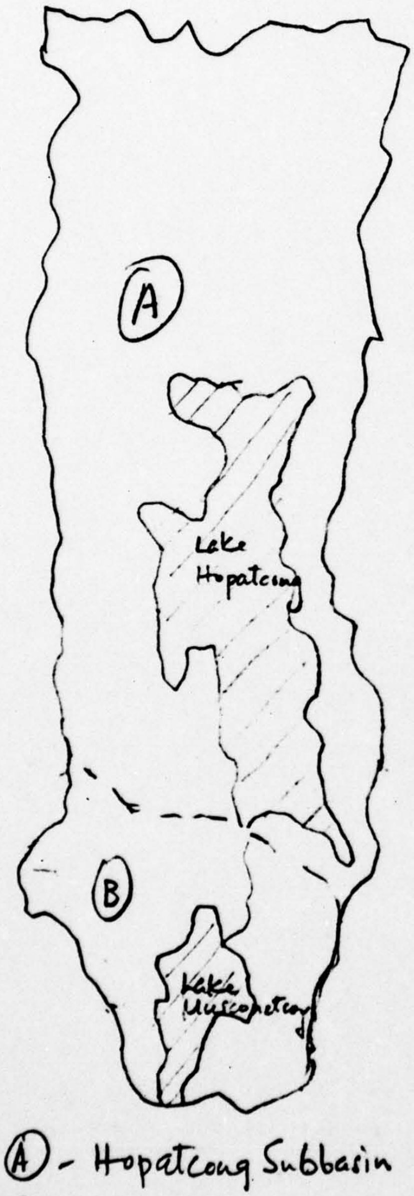
$L_{ca} = 6850 \text{ ft} = 1.30 \text{ mi}$



$\therefore t_p = 3.7 (3.85 \times 1.30)^{0.3} \doteq 6.0 \text{ hrs.}$

$\therefore$ $t_p = 6$ hrs. and $C_p = 0.58$ (given)

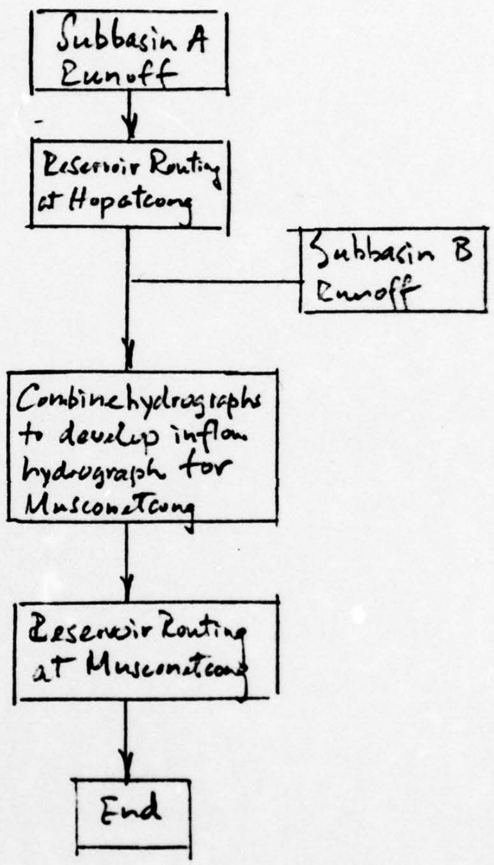
Catchment Basin



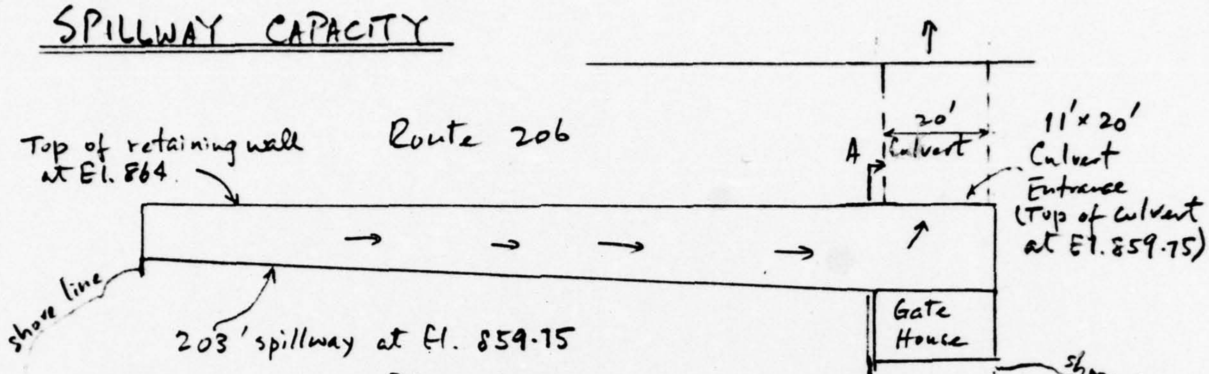
(A) - Hopatcong Subbasin

(B) Musconetcong Subbasin

Schematic Network



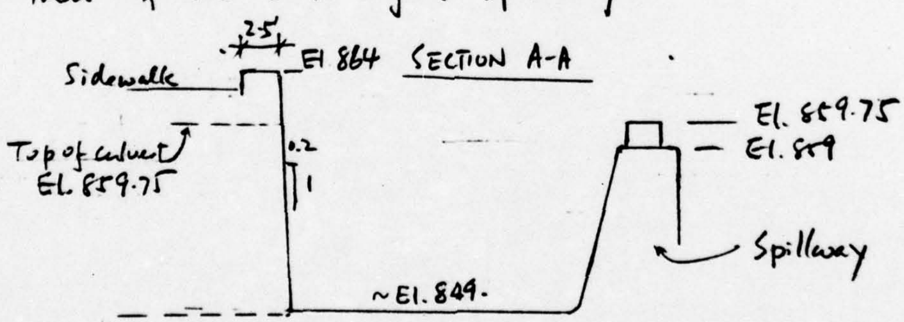
SPILLWAY CAPACITY



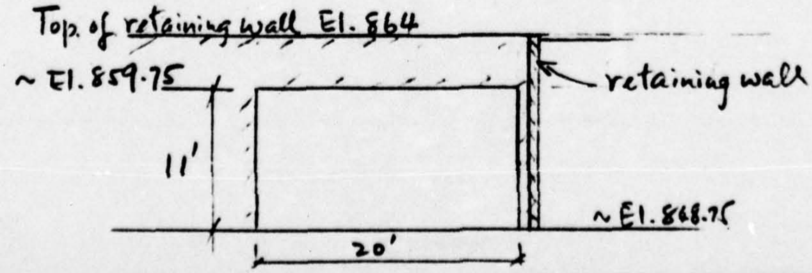
Plan View

Outflow discharge is first governed by the spillway. As discharge increases, the headwater in the culvert rises. Eventually the headwater rises to the same elevation as the spillway and top of culvert. At this time the culvert entrance is filled and the spillway is submerged. Discharge capacity will be governed by the culvert if its capacity is less than that of the submerged spillway.

SECTION A-A



Culvert Entrance



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Discharge capacity of Culvert when spillway just becomes submerged or spillway discharge chamber filled (headwater for culvert at 859.75):

'Open-Channel Hydraulics' by Chow, 1959

Fig. 17-29 on pg. 498.

$\frac{H}{d} = 1$, $d = 11'$, then $Q/b = 120$

$\therefore Q = 120 \times 20 = 2400$ cfs.

Approximate head above spillway when culvert entrance filled

$H = \left(\frac{Q}{CL}\right)^{2/3}$

$= \left(\frac{2400}{3.3 \times 203}\right)^{2/3}$

$= 2.34$ ft.

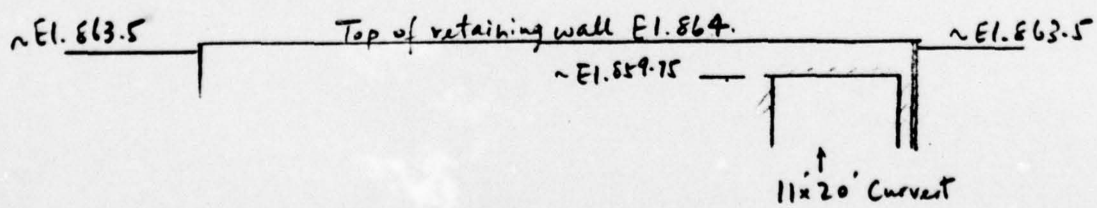
Choose $C = 3.3$ (Table 5-3 of 'Handbook of Hydraulics' by King & Brater)

Elevation at two end of the retaining wall is approximately 863.5. Assume discharge obeys weir equation when overtop.

Use $C_{avg.} = 2.5$ and $L = 200'$

Use $C_{avg.} = 2.7$ for retaining wall portion which is at El. 864.

Length of retaining wall ≑ 233'



Profile Section along retaining wall

BY. Dy	DATE 2-3-79	Lake Musconetcong Dam	JOB NO. J-783B
CKD GED	DATE 3-28-79		SHEET NO. 5 OF 12

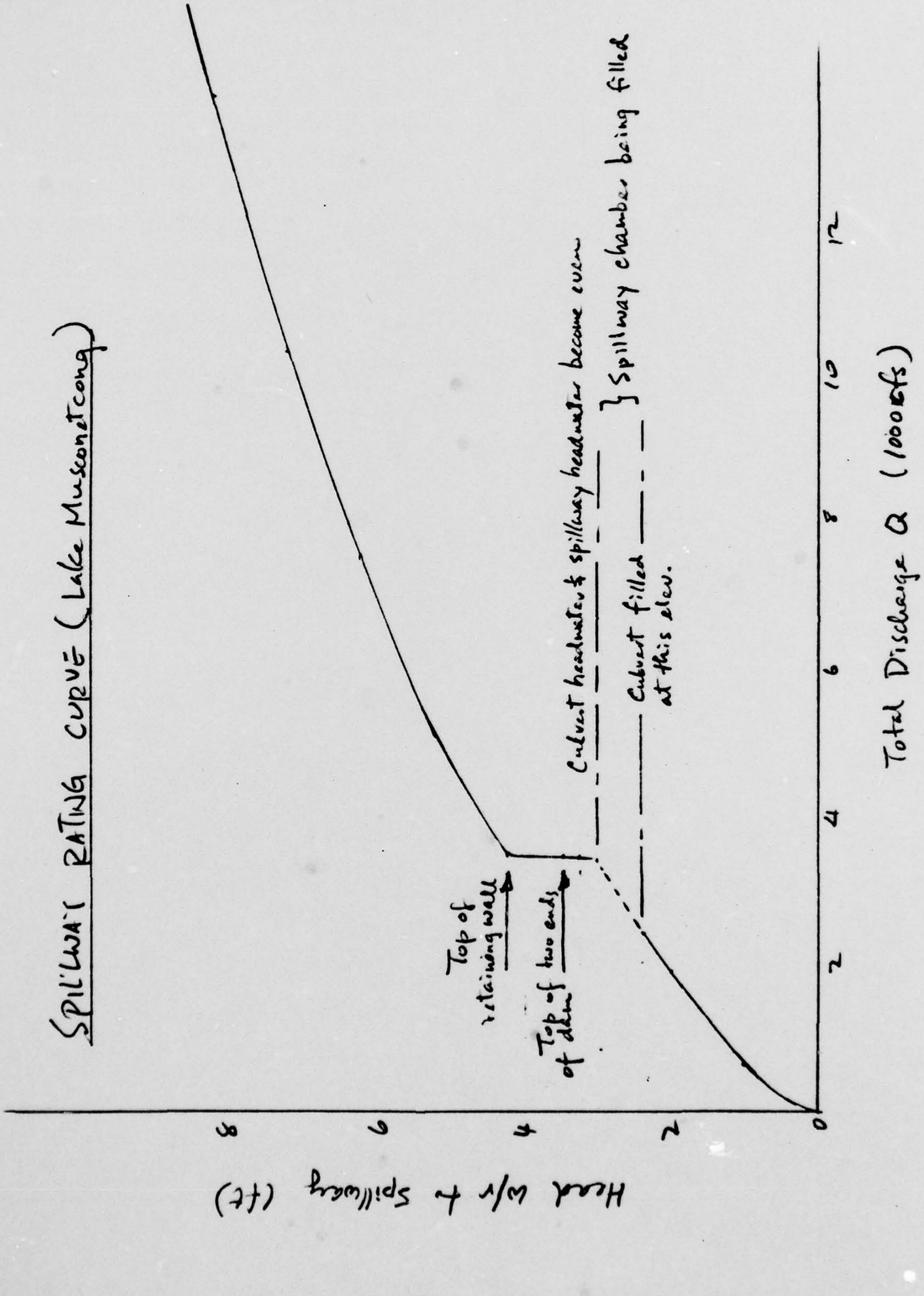
Elevation (ft)	Spillway			Culvert				Two ends of dam		Retaining wall		Total (cfs)
	H(ft)	C	Q_s(cfs)	H(ft)	H/d	Q/b	Q_c(cfs)	H(ft)	Q_E(cfs)	H(ft)	Q_R(cfs)	$Q_T = Q_c + Q_E + Q_R$
859.75	0											0
860.75	1	2.98	605	4.62	0.42	30	605					605
861.75	2	3.30	1895	9.9	0.9	95	1895					1895
862.75	3	3.32	3502	14	1.27	170	3400					3400
863.50	3.5		Controlled by Culvert	14.75	1.34	173	3460	0				3460
864.00	4.25			15.75	1.43	176	3520	0.5	177	0		3697
865.00	5.25			16.75	1.52	180	3600	1.5	919	1	629	5148
866.00	6.25			17.25	1.57	184	3780	2.5	1976	2	1779	7535
867.00	7.25			18.25	1.66	192	3840	3.5	3274	3	3269	10383
868.00	8.25			19.25	1.75	200	4000	4.5	4773	4	5033	13806

$Q_S = 203\,C H^{3/2}$, $Q_E = 500 H^{3/2}$, $Q_R = 629.1 H^{3/2}$

Q_c obtained from Fig. 17-29 on Pg. 498 of 'Open-Channel Hydraulics' by Chow

BY Pry DATE 2-3-79 Lake Musconetcong JOB NO. J-783 B
CKD GED DATE 3-28-79 SHEET NO. 6 OF 12

LANGAN ENGINEERING ASSOCIATES, INC.



BY: Rug DATE 2-6-79 Lake Musconetcong Dam JOB NO. J-783B

CKD CED DATE 3.28.79 SHEET NO. 7 OF 12

Reservoir Storage Capacity

Assume a linear distribution for the area of the lake with elevation. Start at a zero storage at the crest of the spillway.

Area of Lake = 307 Ac.

Perimeter of Lake = 24,000 ft (measured from U.S.G.S. map)

Since perimeter is estimated from U.S.G.S. map. ∴ for estimated analysis purpose, it is assumed to be constant within the working elevation range.

Take average side slope = 1V : 6H.

∴ for every foot of water above the crest of spillway the area of lake increases by $= \frac{6(24000)}{43560} \doteq 3$ ac.

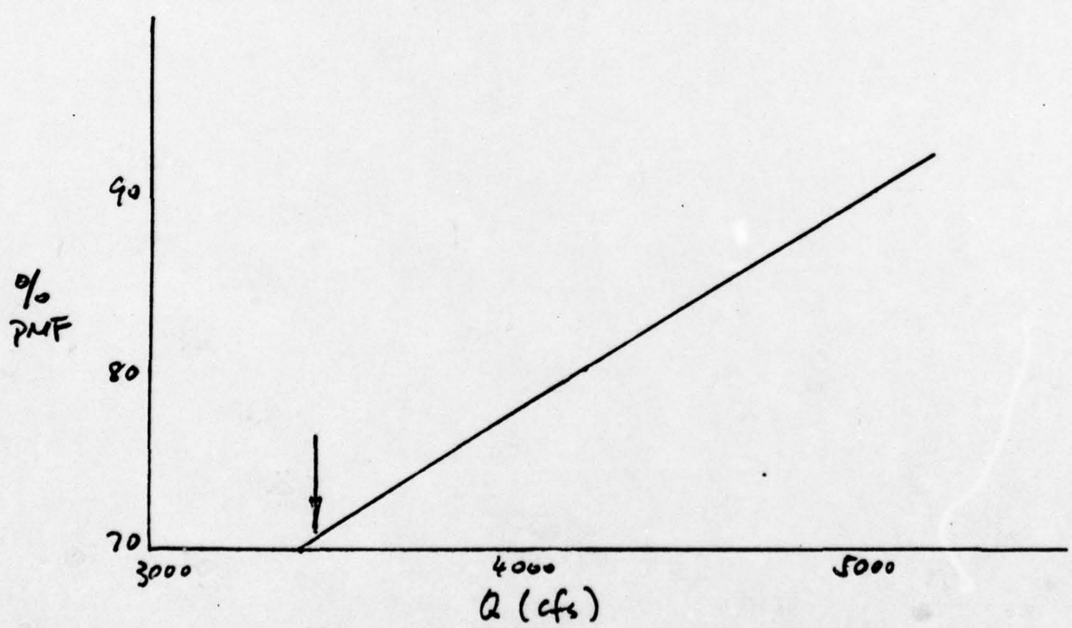
Elev. (ft)	H (ft)	Increase in Lake area (Acres)	Area of Lake (Acres)
859.75	0		307
860.75	1	3	310
861.75	2	6	313
862.75	3	9	316
863.75	4	12	319
864.75	5	15	322
865.75	6	18	325
866.75	7	21	328
867.75	8	24	331
868.75	9	27	334

SUMMARY OF HYDROGRAPH AND FLOOD ROUTING

1. Hydrograph and routing calculated using HEC-1
2. PMF for Lake Musconetcong is 6140 cfs (routed to 5948 cfs)
3. Routing indicates the two ends of the dam will overtop by approximately 1.8 ft and the retaining wall running parallel to the roadway will overtop by approximately 1.3 ft for PMF.

OVERTOPPING POTENTIAL

1. Various % of PMF have been routed using HEC-1
2. Plot peak outflow vs % PMF



3. Dam overtops at approx. El. 863.5 with Q = 3460 cfs.
∴ dam can pass approx. 71% of PMF.

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DRAWDOWN ANALYSIS

1. Outlet structures

   4 - 3' × 5' sluicegates

   1 - 36" pipe that leads to the canal.

2. Outlet capacity

   Sill of gates at El. 850.0

   Top of gates at El. 855.0

   ℄ of 36" pipe at El. 856.0

Consider pipe discharge when pool elevation is above El. 856.0, Assume orifice flow.
When pool elevation is above El. 855.0, gate discharge is governed by orifice flow. As pool elevation is lowered below El. 855.0, gate discharge is governed by weir flow. Use $c = 3.33$ for weir flow and $c = 0.62$ for orifice flow for the gates (available original design data) Use $C = 0.6$ for pipe.

Elev. (ft.)		Gates Head (ft)	Gates Q_g (cfs)	36" pipe Head (ft)	36" pipe Q_p (cfs)	Q_T (cfs)	$Q_{out\,ave.}$ (cfs)
860		7.5	817	4	68	885	852
859		6.5	761	3	59	820	784
858	Orifice	5.5	700	2	48	748	598
857	Orifice	4.5	633	1	34	667	613
856	Orifice	3.5	558	0	0	558	503
855		5	447			447	384
854	Weir	4	320			320	264
853	Weir	3	208			208	161
852		2	113			113	77
851		1	40			40	20
850		0	0			0	

BY Dy DATE 2-2-79 Lake Musconetcong Dam JOB NO. J-783 B

CKD. GED DATE 3.28.79 SHEET NO. 10 OF 12

LANGAN ENGINEERING ASSOCIATES, INC.

3. Storage Capacity

a. Estimated usable storage above the lowest elevation of the gates is 1800 ac. ft.

b. Assume area varies linearly with height, Area of lake at bottom of gates ≑ 53 acres

Elev.	Area (Ac)	ΔStorage (ac-ft)	Total Storage (Ac-ft)
860	307		1800
		295	
859	282		
		269	
858	256		
		244	
857	231		
		218	
856	205		
		180	
855	180		
		168	
854	155		
		142	
853	129		
		117	
852	104		
		91	
851	78		
		66	
850	53		

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4. Assume inflow to be 2 cfs / sq. mi

$Q_{in} = 30.3 \times 2 = 60.6$ cfs

Elev. (ft)	Qout ave. (cfs)	Qnet* (cfs)	Δ Storage (Ac-ft)	Δt (hr.)	ΣΔt (hr)	
860						
	852	791	295	4.5		
859						
	784	723	269	4.5		
858						
	598	537	244	5.5		
857						
	613	552	218	4.8		
856						
	503	442	180	4.9	24.2	1 day.
855						
	384	323	168	6.3		
854						
	264	203	142	8.5		
853						
	161	100	117	14.2		
852						
	77	16	91	68.8	122	5 days
851						
	20	-**	-			
850						

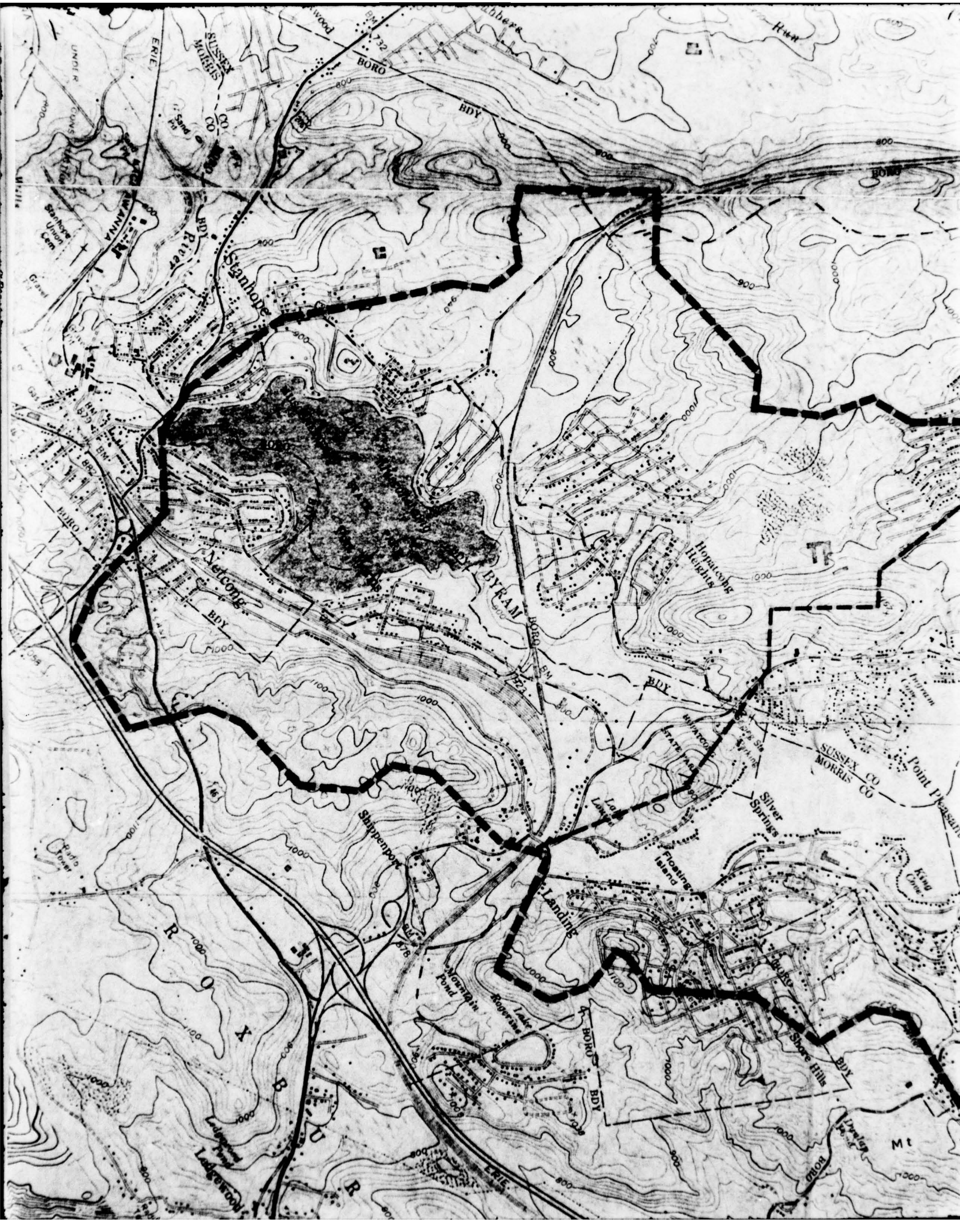
* $Q_{net} = Q_{out\ ave} - Q_{in} = Q_{out\ ave} - 61$

** $Q_{in} > Q_{out}$ not considered.

Lake can be lowered 5 feet in about 1 day and 9 feet in about 5 days

BY Dy DATE 2-2-79 Lake Musconetcong Dam JOB NO. I-783 B

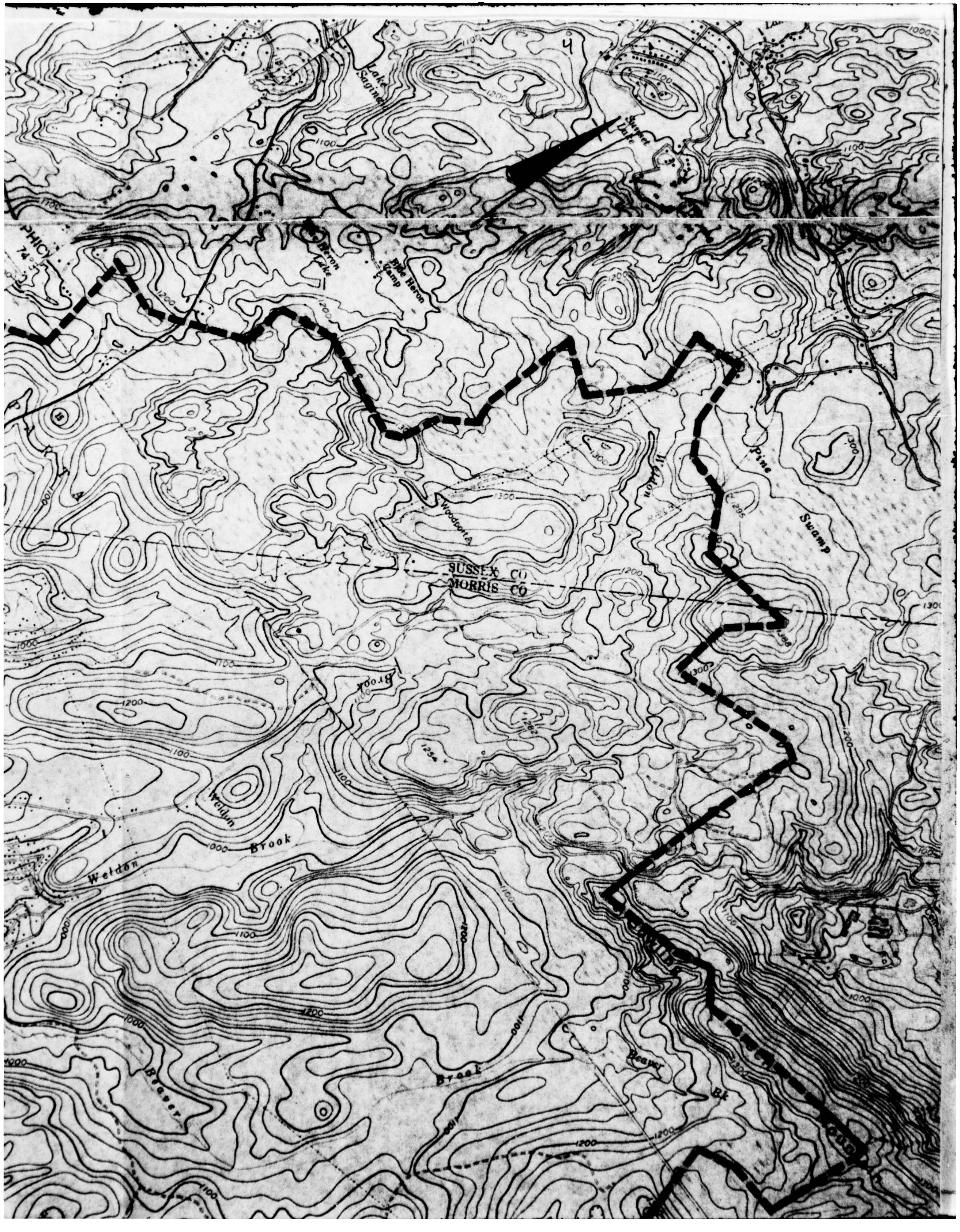
CKD. GED DATE 3.28.79 SHEET NO. 12 OF 12



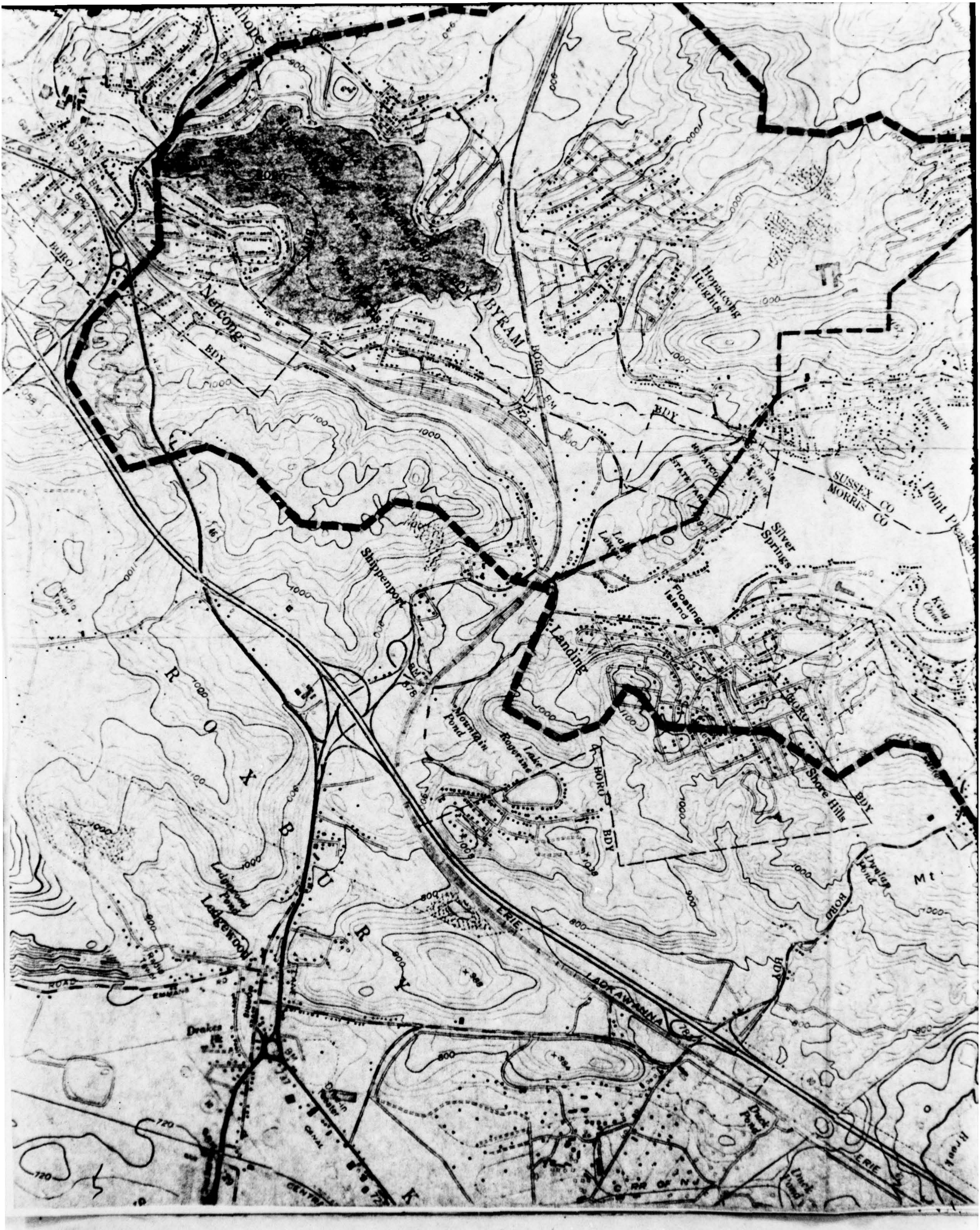
SUSSEX CO
MORRIS CO
BORO
BDY
ERIE
Stanhope
Stanhope Union Cem
River
Netcong
BYRAM
Hopatcong Heights
Silver Springs
Floating Island
Point Pleasant
Landing
Shippenport
Mountain Pond
Lake Rogerine
Shore Hills
King Cove
Radio Tower
Ledgewood Pond
Ledgewood
R
O
X
B
U
R
Mt


Dallis Pond
BORO
BDY
Hopatcong Hills
Bear Pond
Byram Cove
Sister Islands
Pine Tree Pt
Sun Rise Pt
Byram Bay
Indian Island
Cow Tongue Point
Henderson Bay
Lookout Mtn
Sperry Springs
Indian Harbor
Raccoon Island
Point Breeze
MORRIS CO
SUSSEX CO
Hopatcong
River Styx
Bonaparte Landing
Bishops Rock
Davis Cove
Prospect Point
Halsey Island
Elba Pt
Ingram Cove
Bedbug Island
Sharps Pt
Pickerel Pt
LAKE HOPATCONG
SPILLWAY ELEVATION 924 FEET
JEFFERSON
Point Pleasant
Bertrand Island
Chestnut Pt
Nolans Pt
Espanong
King Cove
Our Lady of the Lake Ch
Van Every Cove
Great Cove
Lake Hopatcong
Mount Arlington
Lake Hopatcong PO
Mt Arlington Sch
Mt Arlington
Mt
1000
1100
900
800

Run
BDY
Tomahawk Lake
BORO
SPARTA
Mountain Lk
Northwood
Indian Island
Henderson Bay
Henderson Cove
BORO BDY
Brook
County
SUSSEX
MORRIS
CO
CO
Indian Harbor
Raccoon Island
Prospect Point
Liffy Island
LAKE HOPATCONG
Woodport
Weldon
Lake Shawnee
Hurdtown
Tierneys Corner
Espanong
Lake Hopatcong P.O.
Beaver



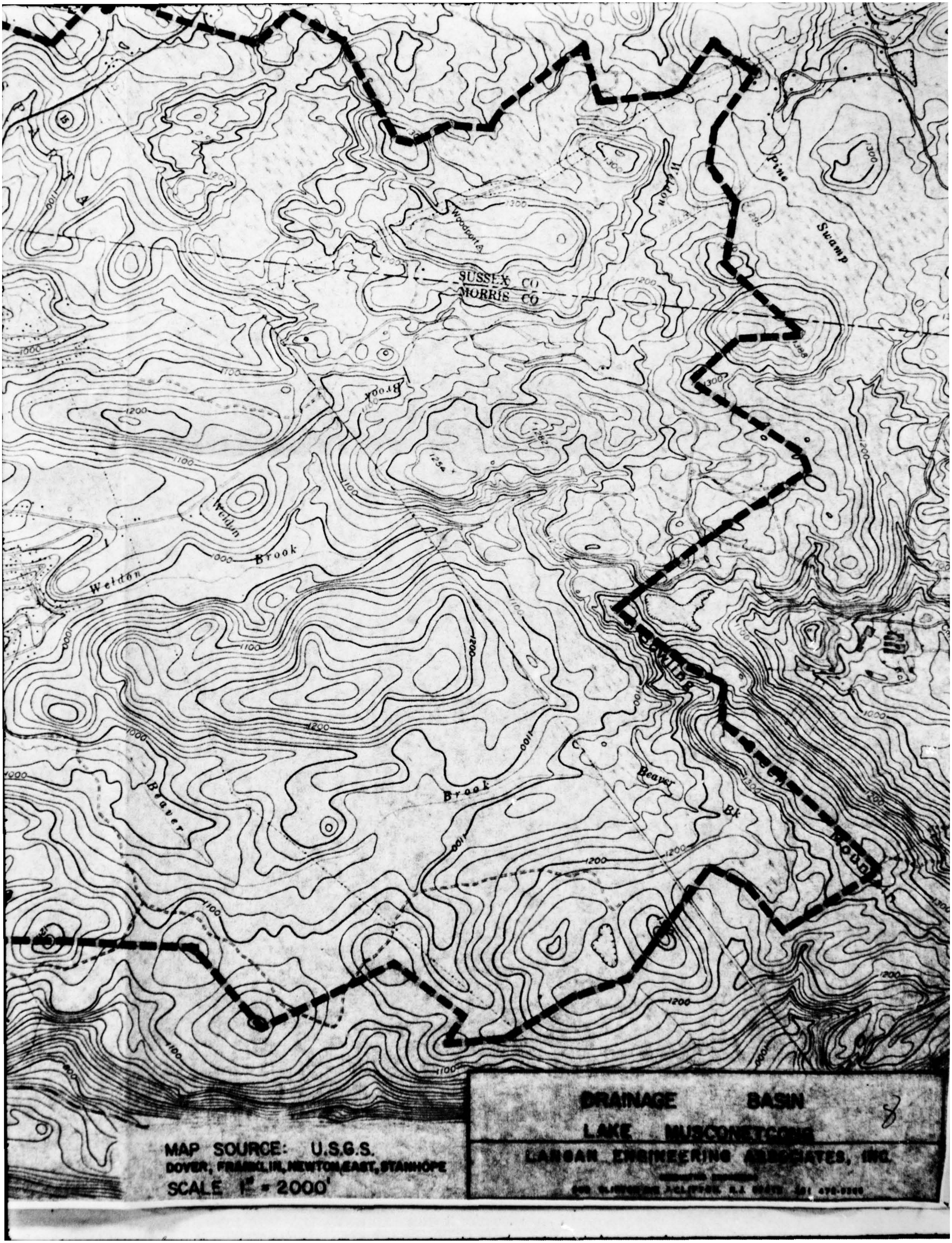
4
Lake Sagrimore
Blue Heron Lake
Blue Heron Camp
Weldon
Pine
Swamp
Woodport
SUSSEX CO
MORRIS CO
Brook
Weldon
Weldon
Brook
Beaver
Brook
Beaver
Bk
1100
1200
1300
1000



Netcong
BYRAM
BORO
BDY
Hopatcong Heights
Shippenport
Landing
Floating Island
Silver Springs
SUSSEX CO
MORRIS CO
King Cove
Mountain Pond
Lake Rogerine
Shore Hills
R O X B U R Y
Ledgewood Pond
Ledgewood
Drakes
Duck Pond
ERIE
LACKAWANNA
ROAD


Byram Cove
Sister Islands
Pine Tree Pt
Sun Rise Pt
Byram Bay
Lookout Mtn
Sperry Springs
Indian Island
Cow Tongue Point
Indian Harbor
Point Breeze
MORRIS CO
SUSSEX CO
Prospect Point
Hopatcong
River Styx
Davis Cove
Bonaparte Landing
Bishops Rock
Halsey Island
Elba Pt
Bedbug Island
LAKE HOPATCONG
BORO BDY
Sharps Pt
Pickerel Pt
SPILLWAY 924 FEET ELEVATION
Espanong
Nolans Pt
Point Pleasant
SUSSEX CO
MORRIS CO
Silver Springs
Bertrand Island
Chestnut Pt
Van Every Cove
Our Lady of the Lake Ch
King Cove
Great Cove
Lake Hopatcong
Lake Hopatcong PO
Espanong PO
Mount Arlington
Mt Arlington Sch
Shore Hills
Mt Arlington
Rockaway
Duck Pond


Sister Islands
Northwood
Indian Island
Cow Tongue Point
Henderson Bay
Henderson Cove
BORO
BDY
SUSSEX
MORRIS
County
Hopatcong
Indian Harbor
Raccoon Island
Point Breeze
Prospect Point
Halsey Island
Liffy Island
LAKE
HOPATCONG
Woodport
Lake
Shawnee
Weldon
Hurdtown
Tierneys Corner
Espanong
Lake Hopatcong PO
River


SUSSEX CO
MORRIS CO
Pine
Swamp
Woodport
Brook
Weldon
Brook
Weldon
Beaver
Brook
Beaver
Bk
Mountain
1200
1100
1000
1300
1254
1282
DRAINAGE BASIN
LAKE MUSCONETCONG
LANGAN ENGINEERING ASSOCIATES, INC.
MAP SOURCE: U.S.G.S.
DOVER, FRANKLIN, NEWTON EAST, STANHOPE
SCALE 1" = 2000'

HEC-1 OUTPUT

LAKE MUSCONETCONG DAM

```
MUSOUT1     17:39 FEB 05,'79

1***********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  25 SEP 78
 ***********************************
A                                 LAKE MJSCONETCONG DAM
A                                 INFLOW HYDROGRAPH AND ROUTING
A                                 N.J. DAM INSPECTION
B     150        1        0        0        0        0        0        0        0        0
B1      3
K                1                                            1
K1   COMPUTE HYDROGRAPH - HOPATCONG LOCAL
M       1        1     25.4                       0.82
P             22.4      104      113      123      135
T                                                             1      .15
W    12.0     0.58
X      -2                 1
K       1        2                                            1
K1   ROUTING COMPUTATIONS - HOPATCONG
Y                                  1
Y1      1                                                             -1
Y4 923.3    924.3    925.3    926.3    927.7    928.7    929.7    930.7    931.7
Y5      0      333      942     1730     3073     4497     6291     8355    10651
$A   2474     2491     2508     2525     2542     2559     2576     2593     2610     2627
$A   2644     2661
$E 923.3    924.3    925.3    926.3    927.3    928.3    929.3    930.3    931.3    932.3
$E 933.3    934.3
$$ 923.3
$D 927.7
K                2                                            1
K1   COMPUTE HYDROGRAPH - MUSCONETCONG LOCAL
M       1        1      4.9                        .80
P             22.4      112      123      132      142
T                                                             1      .15
W       6      .58
X      -2                 1
K       2        2                                            1
K1   COMBINE OUTFLOW OF HOPATCONG WITH LOCAL INFLOW OF MUSCONETCONG
K       1        3                                            1
K1   ROUTING COMPUTATIONS - MUSCONETCONG
Y                                  1
Y1      1                                                             -1
Y4859.75   860.75   861.75   862.75   863.50   864.00   865.00   866.00   867.00   868.00
Y5      0      605     1895     3400     3460     3697     5148     7535    10383    13806
$A    307      310      313      316      319      322      325      328      331      334
```

```
41            $E859.75  860.75  861.75  862.75  863.75  864.75  865.75  866.75  867.75  868.75
42            $$859.75
43            $D863.50
44            K      99
                    PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                              RUNOFF HYDROGRAPH AT            1
                              ROUTE HYDROGRAPH TO             2
                              RUNOFF HYDROGRAPH AT            2
                              COMBINE   2 HYDROGRAPHS AT      2
                              ROUTE HYDROGRAPH TO             3
                              END OF NETWORK

1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION       JULY 1978
   LAST MODIFICATION  25 SEP 78
 **********************************

 RUN  DATE# 79/02/05.
      TIME# 17.31.04.


                                    LAKE MUSCONETCONG DAM
                                    INFLOW HYDROGRAPH AND ROUTING
                                    N.J. DAM INSPECTION

                                            JOB SPECIFICATION
              NQ       NHR      NMIN      IDAY       IHR      IMIN     METRC      IPLT      IPRT     NSTAN
             150         1         0         0         0         0         0         0         0         0
                                         JOPER       NWT     LROPT     TRACE
                                             3         0         0         0


         **********          **********          **********          **********          **********

                                      SUB-AREA RUNOFF COMPUTATION

             COMPUTE HYDROGRAPH - HOPATCONG LOCAL

                          ISTAQ     ICOMP     IECON     ITAPE      JPLT      JPRT     INAME    ISTAGE     IAUTO
                              1         0         0         0         0         0         1         0         0

                                                  HYDROGRAPH DATA
             IHYDG      IUHG     TAREA      SNAP     TRSDA     TRSPC     RATIO     ISNOW     ISAME     LOCAL
                 1         1     25.40      0.00     25.40       .82     0.000         0         0         0

                                                     PRECIP DATA
```

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.40	104.00	113.00	123.00	135.00	0.00	0.00

3

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	FRAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.15	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 12.00 CP= .58 NTA= 0

RECESSION DATA
STRTQ= -2.00 QRCSN= 0.00 RTIOR= 1.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=12.98 AND R=12.76 INTERVALS

UNIT HYDROGRAPH 75 END-OF-PERIOD ORDINATES, LAG= 12.03 HOURS, CP= .58 VOL= 1.00

19.	70.	143.	229.	323.	424.	528.	624.	701.	760.
799.	817.	807.	764.	707.	653.	604.	559.	517.	478.
442.	408.	378.	349.	323.	298.	276.	255.	236.	218.
202.	186.	172.	159.	147.	136.	126.	117.	108.	100.
92.	85.	79.	73.	67.	62.	58.	53.	49.	45.
42.	39.	36.	33.	31.	28.	26.	24.	22.	21.
19.	18.	16.	15.	14.	13.	12.	11.	10.	9.
9.	8.	7.	7.	6.					

0

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	1.00	1	.01	0.00	.01	51.	1.04	4.00	76	0.00	0.00	0.00	2411.
1.01	2.00	2	.01	0.00	.01	51.	1.04	5.00	77	0.00	0.00	0.00	2233.
1.01	3.00	3	.01	0.00	.01	51.	1.04	6.00	78	0.00	0.00	0.00	2068.
1.01	4.00	4	.01	0.00	.01	51.	1.04	7.00	79	0.00	0.00	0.00	1916.
1.01	5.00	5	.01	0.00	.01	51.	1.04	8.00	80	0.00	0.00	0.00	1776.
1.01	6.00	6	.01	0.00	.01	51.	1.04	9.00	81	0.00	0.00	0.00	1646.
1.01	7.00	7	.03	0.00	.03	51.	1.04	10.00	82	0.00	0.00	0.00	1525.
1.01	8.00	8	.03	0.00	.03	51.	1.04	11.00	83	0.00	0.00	0.00	1414.
1.01	9.00	9	.03	0.00	.03	51.	1.04	12.00	84	0.00	0.00	0.00	1311.
1.01	10.00	10	.03	0.00	.03	51.	1.04	13.00	85	0.00	0.00	0.00	1216.
1.01	11.00	11	.03	0.00	.03	51.	1.04	14.00	86	0.00	0.00	0.00	1129.
1.01	12.00	12	.03	0.00	.03	51.	1.04	15.00	87	0.00	0.00	0.00	1047.
1.01	13.00	13	.19	0.00	.19	51.	1.04	16.00	88	0.00	0.00	0.00	972.
1.01	14.00	14	.22	0.00	.22	51.	1.04	17.00	89	0.00	0.00	0.00	903.
1.01	15.00	15	.28	0.00	.28	51.	1.04	18.00	90	0.00	0.00	0.00	838.
1.01	16.00	16	.71	.50	.21	60.	1.04	19.00	91	0.00	0.00	0.00	776.
1.01	17.00	17	.26	.11	.15	88.	1.04	20.00	92	0.00	0.00	0.00	721.
1.01	18.00	18	.21	.06	.15	131.	1.04	21.00	93	0.00	0.00	0.00	670.
1.01	19.00	19	.02	0.00	.02	184.	1.04	22.00	94	0.00	0.00	0.00	623.
1.01	20.00	20	.02	0.00	.02	245.	1.04	23.00	95	0.00	0.00	0.00	580.
1.01	21.00	21	.02	0.00	.02	310.	1.05	0.00	96	0.00	0.00	0.00	540.
1.01	22.00	22	.02	0.00	.02	378.	1.05	1.00	97	0.00	0.00	0.00	503.
1.01	23.00	23	.02	0.00	.02	443.	1.05	2.00	98	0.00	0.00	0.00	469.
1.02	0.00	24	.02	0.00	.02	498.	1.05	3.00	99	0.00	0.00	0.00	[illegible]

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1.02	1.00	25	.12	0.00	.12	541.	1.05	4.00	100	0.00	0.00	0.00	409.
1.02	2.00	26	.12	0.00	.12	571.	1.05	5.00	101	0.00	0.00	0.00	382.
1.02	3.00	27	.12	0.00	.12	587.	1.05	6.00	102	0.00	0.00	0.00	357.
1.02	4.00	28	.12	0.00	.12	587.	1.05	7.00	103	0.00	0.00	0.00	334.
1.02	5.00	29	.12	0.00	.12	565.	1.05	8.00	104	0.00	0.00	0.00	312.
1.02	6.00	30	.12	0.00	.12	531.	1.05	9.00	105	0.00	0.00	0.00	293.
1.02	7.00	31	.28	.13	.15	498.	1.05	10.00	106	0.00	0.00	0.00	274.
1.02	8.00	32	.28	.13	.15	474.	1.05	11.00	107	0.00	0.00	0.00	256.
1.02	9.00	33	.28	.13	.15	461.	1.05	12.00	108	0.00	0.00	0.00	240.
1.02	10.00	34	.28	.13	.15	461.	1.05	13.00	109	0.00	0.00	0.00	225.
1.02	11.00	35	.28	.13	.15	475.	1.05	14.00	110	0.00	0.00	0.00	211.
1.02	12.00	36	.28	.13	.15	503.	1.05	15.00	111	0.00	0.00	0.00	198.
1.02	13.00	37	1.91	1.76	.15	578.	1.05	16.00	112	0.00	0.00	0.00	177.
1.02	14.00	38	2.29	2.14	.15	757.	1.05	17.00	113	0.00	0.00	0.00	154.
1.02	15.00	39	2.87	2.72	.15	1097.	1.05	18.00	114	0.00	0.00	0.00	131.
1.02	16.00	40	7.26	7.11	.15	1725.	1.05	19.00	115	0.00	0.00	0.00	82.
1.02	17.00	41	2.67	2.52	.15	2730.	1.05	20.00	116	0.00	0.00	0.00	65.
1.02	18.00	42	2.10	1.95	.15	4062.	1.05	21.00	117	0.00	0.00	0.00	52.
1.02	19.00	43	.18	.03	.15	5633.	1.05	22.00	118	0.00	0.00	0.00	52.
1.02	20.00	44	.18	.03	.15	7335.	1.05	23.00	119	0.00	0.00	0.00	52.
1.02	21.00	45	.18	.03	.15	9074.	1.06	0.00	120	0.00	0.00	0.00	52.
1.02	22.00	46	.18	.03	.15	10763.	1.06	1.00	121	0.00	0.00	0.00	51.
1.02	23.00	47	.18	.03	.15	12283.	1.06	2.00	122	0.00	0.00	0.00	51.
1.03	0.00	48	.18	.03	.15	13526.	1.06	3.00	123	0.00	0.00	0.00	51.
1.03	1.00	49	0.00	0.00	0.00	14425.	1.06	4.00	124	0.00	0.00	0.00	51.
1.03	2.00	50	0.00	0.00	0.00	14928.	1.06	5.00	125	0.00	0.00	0.00	51.
1.03	3.00	51	0.00	0.00	0.00	15026.	1.06	6.00	126	0.00	0.00	0.00	51.
1.03	4.00	52	0.00	0.00	0.00	14725.	1.06	7.00	127	0.00	0.00	0.00	51.
1.03	5.00	53	0.00	0.00	0.00	14055.	1.06	8.00	128	0.00	0.00	0.00	51.
1.03	6.00	54	0.00	0.00	0.00	13170.	1.06	9.00	129	0.00	0.00	0.00	51.
1.03	7.00	55	0.00	0.00	0.00	12236.	1.06	10.00	130	0.00	0.00	0.00	51.
1.03	8.00	56	0.00	0.00	0.00	11334.	1.06	11.00	131	0.00	0.00	0.00	51.
1.03	9.00	57	0.00	0.00	0.00	10495.	1.06	12.00	132	0.00	0.00	0.00	51.
1.03	10.00	58	0.00	0.00	0.00	9716.	1.06	13.00	133	0.00	0.00	0.00	51.
1.03	11.00	59	0.00	0.00	0.00	8992.	1.06	14.00	134	0.00	0.00	0.00	51.
1.03	12.00	60	0.00	0.00	0.00	8321.	1.06	15.00	135	0.00	0.00	0.00	51.
1.03	13.00	61	0.00	0.00	0.00	7698.	1.06	16.00	136	0.00	0.00	0.00	51.
1.03	14.00	62	0.00	0.00	0.00	7121.	1.06	17.00	137	0.00	0.00	0.00	51.
1.03	15.00	63	0.00	0.00	0.00	6588.	1.06	18.00	138	0.00	0.00	0.00	51.
1.03	16.00	64	0.00	0.00	0.00	6095.	1.06	19.00	139	0.00	0.00	0.00	51.
1.03	17.00	65	0.00	0.00	0.00	5640.	1.06	20.00	140	0.00	0.00	0.00	51.
1.03	18.00	66	0.00	0.00	0.00	5218.	1.06	21.00	141	0.00	0.00	0.00	51.
1.03	19.00	67	0.00	0.00	0.00	4829.	1.06	22.00	142	0.00	0.00	0.00	51.
1.03	20.00	68	0.00	0.00	0.00	4469.	1.06	23.00	143	0.00	0.00	0.00	51.
1.03	21.00	69	0.00	0.00	0.00	4136.	1.07	0.00	144	0.00	0.00	0.00	51.
1.03	22.00	70	0.00	0.00	0.00	3828.	1.07	1.00	145	0.00	0.00	0.00	51.
1.03	23.00	71	0.00	0.00	0.00	3543.	1.07	2.00	146	0.00	0.00	0.00	51.
1.04	0.00	72	0.00	0.00	0.00	3280.	1.07	3.00	147	0.00	0.00	0.00	51.
1.04	1.00	73	0.00	0.00	0.00	3036.	1.07	4.00	148	0.00	0.00	0.00	51.
1.04	2.00	74	0.00	0.00	0.00	2811.	1.07	5.00	149	0.00	0.00	0.00	51.
1.04	3.00	75	0.00	0.00	0.00	2603.	1.07	6.00	150	0.00	0.00	0.00	51.

```
                                                        SUM  24.80  19.82   4.98   330800.
                                                           ( 630.)( 503.)( 126.)( 9367.21)

                 PEAK   6-HOUR  24-HOUR  72-HOUR  TOTAL VOLUME
       CFS      15026.  14418.  10167.    4450.      330738.
       CMS        425.    408.    288.     126.        9365.
    INCHES                5.28   14.89    19.56        20.19
        MM              134.12  378.29   496.79       512.77
     AC-FT               7149.  20165.   26482.       27334.
THOUS CU M               8819.  24873.   32665.       33716.


   **********      **********      **********      **********      **********

                              HYDROGRAPH ROUTING

          ROUTING COMPUTATIONS - HOPATCONG

                  ISTAQ   ICOMP   IECON   ITAPE   JPLT    JPRT   INAME  ISTAGE   IAUTO
                      2       1       0       0      0       0       1       0       0
                                      ROUTING DATA
            QLOSS   CLOSS     AVG    IRES   ISAME   IOPT    IPMP            LSTR
              0.0   0.000    0.00       1       0      0       0               0

                  NSTPS   NSTDL     LAG   AMSKK      X     TSK   STORA  ISPRAT
                      1       0       0   0.000  0.000   0.000      0.      -1

STAGE        923.30    924.30    925.30    926.30    927.70    928.70    929.70    930.70    931.70

FLOW           0.00    333.00    942.00   1730.00   3073.00   4497.00   6291.00   8355.00  10651.00

SURFACE AREA=   2474.     2491.     2508.     2525.     2542.     2559.     2576.     2593.     2610.     2627.
                2644.     2661.

CAPACITY=         0.      2482.     4982.     7498.    10032.    12582.    15150.    17734.    20336.    22954.
               25590.    28242.

ELEVATION=      923.      924.      925.      926.      927.      928.      929.      930.      931.      932.
                933.      934.

                    CREL   SPWID    COQW    EXPW   ELEVL    COQL   CAREA    EXPL
                   923.3     0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                     DAM DATA
                            TOPEL    COQD    EXPD  DAMWID
                            927.7     0.0     0.0      0.
```

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END-OF-PERIOD HYDROGRAPH ORDINATES

MO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	1.00	1	1.00	51.	1.	4.	923.3
1.01	2.00	2	2.00	51.	1.	8.	923.3
1.01	3.00	3	3.00	51.	2.	12.	923.3
1.01	4.00	4	4.00	51.	2.	16.	923.3
1.01	5.00	5	5.00	51.	3.	20.	923.3
1.01	6.00	6	6.00	51.	3.	24.	923.3
1.01	7.00	7	7.00	51.	4.	28.	923.3
1.01	8.00	8	8.00	51.	4.	32.	923.3
1.01	9.00	9	9.00	51.	5.	36.	923.3
1.01	10.00	10	10.00	51.	5.	40.	923.3
1.01	11.00	11	11.00	51.	6.	43.	923.3
1.01	12.00	12	12.00	51.	6.	47.	923.3
1.01	13.00	13	13.00	51.	7.	51.	923.3
1.01	14.00	14	14.00	51.	7.	54.	923.3
1.01	15.00	15	15.00	51.	8.	58.	923.3
1.01	16.00	16	16.00	60.	8.	62.	923.3
1.01	17.00	17	17.00	88.	9.	67.	923.3
1.01	18.00	18	18.00	131.	10.	76.	923.3
1.01	19.00	19	19.00	184.	12.	88.	923.3
1.01	20.00	20	20.00	245.	14.	104.	923.3
1.01	21.00	21	21.00	310.	17.	126.	923.4
1.01	22.00	22	22.00	378.	21.	153.	923.4
1.01	23.00	23	23.00	443.	25.	185.	923.4
1.02	0.00	24	24.00	498.	30.	221.	923.4
1.02	1.00	25	25.00	541.	35.	262.	923.4
1.02	2.00	26	26.00	571.	41.	305.	923.4
1.02	3.00	27	27.00	587.	47.	349.	923.4
1.02	4.00	28	28.00	587.	53.	393.	923.5
1.02	5.00	29	29.00	565.	59.	436.	923.5
1.02	6.00	30	30.00	531.	64.	476.	923.5
1.02	7.00	31	31.00	498.	69.	513.	923.5
1.02	8.00	32	32.00	474.	74.	548.	923.5
1.02	9.00	33	33.00	461.	78.	580.	923.5
1.02	10.00	34	34.00	461.	82.	611.	923.5
1.02	11.00	35	35.00	475.	86.	643.	923.6
1.02	12.00	36	36.00	503.	91.	676.	923.6
1.02	13.00	37	37.00	578.	96.	713.	923.6
1.02	14.00	38	38.00	757.	102.	760.	923.6
1.02	15.00	39	39.00	1097.	111.	828.	923.6
1.02	16.00	40	40.00	1725.	126.	935.	923.7
1.02	17.00	41	41.00	2730.	149.	1107.	923.7
1.02	18.00	42	42.00	4062.	185.	1374.	923.9
1.02	19.00	43	43.00	5633.	236.	1758.	924.0
1.02	20.00	44	44.00	7335.	305.	2271.	924.2
1.02	21.00	45	45.00	9074.	440.	2918.	924.5
1.02	22.00	46	46.00	10763.	629.	3694.	924.8
1.02	23.00	47	47.00	12283.	846.	4585.	925.1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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1.03	0.00	48	48.00	13526.	1127.	5570.	925.5
1.03	1.00	49	49.00	14425.	1455.	6619.	926.0
1.03	2.00	50	50.00	14928.	1805.	7697.	926.4
1.03	3.00	51	51.00	15026.	2212.	8769.	926.8
1.03	4.00	52	52.00	14725.	2601.	9799.	927.2
1.03	5.00	53	53.00	14055.	2963.	10758.	927.6
1.03	6.00	54	54.00	13170.	3392.	11621.	927.9
1.03	7.00	55	55.00	12236.	3811.	12373.	928.2
1.03	8.00	56	56.00	11334.	4169.	13017.	928.5
1.03	9.00	57	57.00	10495.	4472.	13562.	928.7
1.03	10.00	58	58.00	9716.	4782.	14015.	928.9
1.03	11.00	59	59.00	8992.	5038.	14382.	929.0
1.03	12.00	60	60.00	8321.	5241.	14673.	929.1
1.03	13.00	61	61.00	7698.	5396.	14895.	929.2
1.03	14.00	62	62.00	7121.	5509.	15057.	929.3
1.03	15.00	63	63.00	6588.	5584.	15165.	929.3
1.03	16.00	64	64.00	6095.	5626.	15226.	929.3
1.03	17.00	65	65.00	5640.	5640.	15245.	929.3
1.03	18.00	66	66.00	5218.	5628.	15228.	929.3
1.03	19.00	67	67.00	4829.	5594.	15180.	929.3
1.03	20.00	68	68.00	4469.	5541.	15104.	929.3
1.03	21.00	69	69.00	4136.	5472.	15004.	929.2
1.03	22.00	70	70.00	3828.	5389.	14885.	929.2
1.03	23.00	71	71.00	3543.	5293.	14748.	929.1
1.04	0.00	72	72.00	3280.	5188.	14597.	929.1
1.04	1.00	73	73.00	3036.	5074.	14434.	929.0
1.04	2.00	74	74.00	2811.	4954.	14261.	929.0
1.04	3.00	75	75.00	2603.	4828.	14080.	928.9
1.04	4.00	76	76.00	2411.	4697.	13894.	928.8
1.04	5.00	77	77.00	2233.	4564.	13703.	928.7
1.04	6.00	78	78.00	2068.	4442.	13509.	928.7
1.04	7.00	79	79.00	1916.	4332.	13311.	928.6
1.04	8.00	80	80.00	1776.	4221.	13110.	928.5
1.04	9.00	81	81.00	1646.	4108.	12907.	928.4
1.04	10.00	82	82.00	1525.	3995.	12703.	928.3
1.04	11.00	83	83.00	1414.	3881.	12500.	928.3
1.04	12.00	84	84.00	1311.	3768.	12296.	928.2
1.04	13.00	85	85.00	1216.	3655.	12094.	928.1
1.04	14.00	86	86.00	1129.	3544.	11893.	928.0
1.04	15.00	87	87.00	1047.	3433.	11695.	928.0
1.04	16.00	88	88.00	972.	3324.	11499.	927.9
1.04	17.00	89	89.00	903.	3216.	11306.	927.8
1.04	18.00	90	90.00	838.	3110.	11117.	927.7
1.04	19.00	91	91.00	776.	3028.	10930.	927.7
1.04	20.00	92	92.00	721.	2958.	10744.	927.6
1.04	21.00	93	93.00	670.	2889.	10560.	927.5
1.04	22.00	94	94.00	623.	2820.	10378.	927.4
1.04	23.00	95	95.00	580.	2752.	10197.	927.4
1.05	0.00	96	96.00	540.	2684.	10019.	927.3
1.05	1.00	97	97.00	503.	2618.	9843.	927.2
1.05	2.00	98	98.00	469.	2553.	9670.	927.2
1.05	3.00	99	99.00	[illegible]	[illegible]	[illegible]	[illegible]

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1.05	3.00	99	99.00	438.	2488.	9499.	927.1
1.05	4.00	100	100.00	409.	2424.	9331.	927.0
1.05	5.00	101	101.00	382.	2362.	9166.	927.0
1.05	6.00	102	102.00	357.	2301.	9004.	926.9
1.05	7.00	103	103.00	334.	2240.	8844.	926.8
1.05	8.00	104	104.00	312.	2181.	8688.	926.8
1.05	9.00	105	105.00	293.	2123.	8536.	926.7
1.05	10.00	106	106.00	274.	2067.	8386.	926.7
1.05	11.00	107	107.00	256.	2011.	8239.	926.6
1.05	12.00	108	108.00	240.	1957.	8096.	926.5
1.05	13.00	109	109.00	225.	1903.	7955.	926.5
1.05	14.00	110	110.00	211.	1851.	7818.	926.4
1.05	15.00	111	111.00	198.	1801.	7684.	926.4
1.05	16.00	112	112.00	177.	1751.	7553.	926.3
1.05	17.00	113	113.00	154.	1707.	7424.	926.3
1.05	18.00	114	114.00	131.	1667.	7296.	926.2
1.05	19.00	115	115.00	82.	1627.	7169.	926.2
1.05	20.00	116	116.00	65.	1587.	7042.	926.1
1.05	21.00	117	117.00	52.	1549.	6917.	926.1
1.05	22.00	118	118.00	52.	1510.	6795.	926.0
1.05	23.00	119	119.00	52.	1473.	6676.	926.0
1.06	0.00	120	120.00	52.	1437.	6560.	925.9
1.06	1.00	121	121.00	51.	1401.	6447.	925.9
1.06	2.00	122	122.00	51.	1367.	6337.	925.8
1.06	3.00	123	123.00	51.	1333.	6230.	925.8
1.06	4.00	124	124.00	51.	1301.	6125.	925.8
1.06	5.00	125	125.00	51.	1269.	6023.	925.7
1.06	6.00	126	126.00	51.	1238.	5924.	925.7
1.06	7.00	127	127.00	51.	1207.	5827.	925.6
1.06	8.00	128	128.00	51.	1178.	5733.	925.6
1.06	9.00	129	129.00	51.	1149.	5641.	925.6
1.06	10.00	130	130.00	51.	1121.	5551.	925.5
1.06	11.00	131	131.00	51.	1093.	5464.	925.5
1.06	12.00	132	132.00	51.	1067.	5379.	925.5
1.06	13.00	133	133.00	51.	1041.	5296.	925.4
1.06	14.00	134	134.00	51.	1015.	5215.	925.4
1.06	15.00	135	135.00	51.	991.	5136.	925.4
1.06	16.00	136	136.00	51.	966.	5060.	925.3
1.06	17.00	137	137.00	51.	943.	4985.	925.3
1.06	18.00	138	138.00	51.	925.	4912.	925.3
1.06	19.00	139	139.00	51.	908.	4841.	925.2
1.06	20.00	140	140.00	51.	891.	4770.	925.2
1.06	21.00	141	141.00	51.	874.	4702.	925.2
1.06	22.00	142	142.00	51.	858.	4634.	925.2
1.06	23.00	143	143.00	51.	842.	4568.	925.1
1.07	0.00	144	144.00	51.	826.	4504.	925.1
1.07	1.00	145	145.00	51.	810.	4440.	925.1
1.07	2.00	146	146.00	51.	795.	4378.	925.1
1.07	3.00	147	147.00	51.	780.	4317.	925.0
1.07	4.00	148	148.00	51.	766.	4258.	925.0
1.07	5.00	149	149.00	51.	752.	4199.	925.0

1.07 6.00 150 150.00 51. 738. 5142. 925.0

PEAK OUTFLOW IS 5640. AT TIME 65.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5640.	5600.	5103.	3406.	280676.
CMS	160.	159.	145.	96.	7948.
INCHES		2.05	7.48	14.97	17.13
MM		52.09	189.89	380.21	435.16
AC-FT		2777.	10122.	20268.	23196.
THOUS CU M		3425.	12486.	25000.	28612.

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

COMPUTE HYDROGRAPH - MUSCONETCONG LOCAL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	4.90	0.00	4.90	.80	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.40	112.00	123.00	132.00	142.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.15	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 6.00 CP= .58 NTA= 0

RECESSION DATA

STRTQ= -2.00 QRCSN= 0.00 RTIOR= 1.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 6.77 AND R= 6.15 INTERVALS

UNIT HYDROGRAPH 37 END-OF-PERIOD ORDINATES, LAG= 6.00 HOURS, CP= .58 VOL= 1.00

19. 70. 140. 214. 276. 309. 308. 274. 233. 198.

[illegible] 143. 122. 103. 88. 73. 63. 54. 46. 39.
33. 28. 24. 20. 17. 15. 12. 11. 9. 8.
6. 5. 5. 4. 3. 3. 2.

0

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	1.00	1	.01	0.00	.01	10.	1.04	4.00	76	0.00	0.00	0.00	43.
1.01	2.00	2	.01	0.00	.01	10.	1.04	5.00	77	0.00	0.00	0.00	23.
1.01	3.00	3	.01	0.00	.01	10.	1.04	6.00	78	0.00	0.00	0.00	15.
1.01	4.00	4	.01	0.00	.01	10.	1.04	7.00	79	0.00	0.00	0.00	10.
1.01	5.00	5	.01	0.00	.01	10.	1.04	8.00	80	0.00	0.00	0.00	10.
1.01	6.00	6	.01	0.00	.01	10.	1.04	9.00	81	0.00	0.00	0.00	10.
1.01	7.00	7	.02	0.00	.02	10.	1.04	10.00	82	0.00	0.00	0.00	10.
1.01	8.00	8	.02	0.00	.02	10.	1.04	11.00	83	0.00	0.00	0.00	10.
1.01	9.00	9	.02	0.00	.02	10.	1.04	12.00	84	0.00	0.00	0.00	10.
1.01	10.00	10	.02	0.00	.02	10.	1.04	13.00	85	0.00	0.00	0.00	10.
1.01	11.00	11	.02	0.00	.02	10.	1.04	14.00	86	0.00	0.00	0.00	10.
1.01	12.00	12	.02	0.00	.02	10.	1.04	15.00	87	0.00	0.00	0.00	10.
1.01	13.00	13	.15	0.00	.15	10.	1.04	16.00	88	0.00	0.00	0.00	10.
1.01	14.00	14	.18	0.00	.18	10.	1.04	17.00	89	0.00	0.00	0.00	10.
1.01	15.00	15	.23	0.00	.23	10.	1.04	18.00	90	0.00	0.00	0.00	10.
1.01	16.00	16	.58	.25	.33	15.	1.04	19.00	91	0.00	0.00	0.00	10.
1.01	17.00	17	.21	.06	.15	29.	1.04	20.00	92	0.00	0.00	0.00	10.
1.01	18.00	18	.17	.02	.15	50.	1.04	21.00	93	0.00	0.00	0.00	10.
1.01	19.00	19	.01	0.00	.01	73.	1.04	22.00	94	0.00	0.00	0.00	10.
1.01	20.00	20	.01	0.00	.01	95.	1.04	23.00	95	0.00	0.00	0.00	10.
1.01	21.00	21	.01	0.00	.01	108.	1.05	0.00	96	0.00	0.00	0.00	10.
1.01	22.00	22	.01	0.00	.01	111.	1.05	1.00	97	0.00	0.00	0.00	10.
1.01	23.00	23	.01	0.00	.01	103.	1.05	2.00	98	0.00	0.00	0.00	10.
1.02	0.00	24	.01	0.00	.01	91.	1.05	3.00	99	0.00	0.00	0.00	10.
1.02	1.00	25	.11	0.00	.11	79.	1.05	4.00	100	0.00	0.00	0.00	10.
1.02	2.00	26	.11	0.00	.11	68.	1.05	5.00	101	0.00	0.00	0.00	10.
1.02	3.00	27	.11	0.00	.11	60.	1.05	6.00	102	0.00	0.00	0.00	10.
1.02	4.00	28	.11	0.00	.11	52.	1.05	7.00	103	0.00	0.00	0.00	10.
1.02	5.00	29	.11	0.00	.11	46.	1.05	8.00	104	0.00	0.00	0.00	10.
1.02	6.00	30	.11	0.00	.11	40.	1.05	9.00	105	0.00	0.00	0.00	10.
1.02	7.00	31	.33	.18	.15	39.	1.05	10.00	106	0.00	0.00	0.00	10.
1.02	8.00	32	.33	.18	.15	48.	1.05	11.00	107	0.00	0.00	0.00	10.
1.02	9.00	33	.33	.18	.15	69.	1.05	12.00	108	0.00	0.00	0.00	10.
1.02	10.00	34	.33	.18	.15	105.	1.05	13.00	109	0.00	0.00	0.00	10.
1.02	11.00	35	.33	.18	.15	152.	1.05	14.00	110	0.00	0.00	0.00	10.
1.02	12.00	36	.33	.18	.15	205.	1.05	15.00	111	0.00	0.00	0.00	10.
1.02	13.00	37	2.01	1.86	.15	290.	1.05	16.00	112	0.00	0.00	0.00	10.
1.02	14.00	38	2.41	2.26	.15	463.	1.05	17.00	113	0.00	0.00	0.00	10.
1.02	15.00	39	3.01	2.86	.15	777.	1.05	18.00	114	0.00	0.00	0.00	10.
1.02	16.00	40	7.63	7.48	.15	1357.	1.05	19.00	115	0.00	0.00	0.00	10.
1.02	17.00	41	2.81	2.66	.15	2251.	1.05	20.00	116	0.00	0.00	0.00	10.
1.02	18.00	42	2.21	2.06	.15	3329.	1.05	21.00	117	0.00	0.00	0.00	10.
1.02	19.00	43	.16	.01	.15	4392.	1.05	22.00	118	0.00	0.00	0.00	10.
1.02	20.00	44	.16	.01	.15	5193.	1.05	23.00	119	0.00	0.00	0.00	10.
1.02	21.00	45	.16	.01	.15	[illegible]	[illegible]	[illegible]					

1.02	21.00	45	.16	.01	.15	5580.	1.06	0.00	120	0.00	0.00	0.00	10.
1.02	22.00	46	.16	.01	.15	5511.	1.06	1.00	121	0.00	0.00	0.00	10.
1.02	23.00	47	.16	.01	.15	5059.	1.06	2.00	122	0.00	0.00	0.00	10.
1.03	0.00	48	.16	.01	.15	4432.	1.06	3.00	123	0.00	0.00	0.00	10.
1.03	1.00	49	0.00	0.00	0.00	3798.	1.06	4.00	124	0.00	0.00	0.00	10.
1.03	2.00	50	0.00	0.00	0.00	3233.	1.06	5.00	125	0.00	0.00	0.00	10.
1.03	3.00	51	0.00	0.00	0.00	2752.	1.06	6.00	126	0.00	0.00	0.00	10.
1.03	4.00	52	0.00	0.00	0.00	2343.	1.06	7.00	127	0.00	0.00	0.00	10.
1.03	5.00	53	0.00	0.00	0.00	1993.	1.06	8.00	128	0.00	0.00	0.00	10.
1.03	6.00	54	0.00	0.00	0.00	1695.	1.06	9.00	129	0.00	0.00	0.00	10.
1.03	7.00	55	0.00	0.00	0.00	1442.	1.06	10.00	130	0.00	0.00	0.00	10.
1.03	8.00	56	0.00	0.00	0.00	1227.	1.06	11.00	131	0.00	0.00	0.00	10.
1.03	9.00	57	0.00	0.00	0.00	1044.	1.06	12.00	132	0.00	0.00	0.00	10.
1.03	10.00	58	0.00	0.00	0.00	888.	1.06	13.00	133	0.00	0.00	0.00	10.
1.03	11.00	59	0.00	0.00	0.00	756.	1.06	14.00	134	0.00	0.00	0.00	10.
1.03	12.00	60	0.00	0.00	0.00	644.	1.06	15.00	135	0.00	0.00	0.00	10.
1.03	13.00	61	0.00	0.00	0.00	549.	1.06	16.00	136	0.00	0.00	0.00	10.
1.03	14.00	62	0.00	0.00	0.00	468.	1.06	17.00	137	0.00	0.00	0.00	10.
1.03	15.00	63	0.00	0.00	0.00	399.	1.06	18.00	138	0.00	0.00	0.00	10.
1.03	16.00	64	0.00	0.00	0.00	340.	1.06	19.00	139	0.00	0.00	0.00	10.
1.03	17.00	65	0.00	0.00	0.00	291.	1.06	20.00	140	0.00	0.00	0.00	10.
1.03	18.00	66	0.00	0.00	0.00	248.	1.06	21.00	141	0.00	0.00	0.00	10.
1.03	19.00	67	0.00	0.00	0.00	213.	1.06	22.00	142	0.00	0.00	0.00	10.
1.03	20.00	68	0.00	0.00	0.00	182.	1.06	23.00	143	0.00	0.00	0.00	10.
1.03	21.00	69	0.00	0.00	0.00	155.	1.07	0.00	144	0.00	0.00	0.00	10.
1.03	22.00	70	0.00	0.00	0.00	133.	1.07	1.00	145	0.00	0.00	0.00	10.
1.03	23.00	71	0.00	0.00	0.00	114.	1.07	2.00	146	0.00	0.00	0.00	10.
1.04	0.00	72	0.00	0.00	0.00	98.	1.07	3.00	147	0.00	0.00	0.00	10.
1.04	1.00	73	0.00	0.00	0.00	85.	1.07	4.00	148	0.00	0.00	0.00	10.
1.04	2.00	74	0.00	0.00	0.00	69.	1.07	5.00	149	0.00	0.00	0.00	10.
1.04	3.00	75	0.00	0.00	0.00	56.	1.07	6.00	150	0.00	0.00	0.00	10.
									SUM	25.45	20.64	4.81	66438.
										(646.)	(524.)	(122.)	(1881.31)

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	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5580.	4978.	2530.	912.	66409.
CMS	158.	141.	72.	26.	1880.
INCHES		9.45	19.21	20.77	21.01
MM		240.05	487.90	527.65	533.71
AC-FT		2468.	5017.	5426.	5488.
THOUS CU M		3045.	6189.	6693.	6770.

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COMBINE HYDROGRAPHS

COMBINE OUTFLOW OF HOPATCONG WITH LOCAL INFLOW OF MUSCONETCONG

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	2	0	0	0	0	1	0	0

SUM OF 2 HYDROGRAPHS AT 2

10.	11.	11.	12.	13.	13.	14.	14.	15.	15.
16.	16.	17.	17.	18.	23.	38.	60.	85.	109.
125.	132.	128.	121.	114.	109.	107.	105.	104.	104.
108.	121.	147.	187.	238.	296.	386.	565.	888.	1483.
2399.	3513.	4628.	5497.	6019.	6140.	5904.	5558.	5254.	5039.
4964.	4944.	4956.	5087.	5253.	5396.	5516.	5670.	5794.	5885.
5945.	5976.	5983.	5967.	5930.	5876.	5807.	5723.	5627.	5522.
5407.	5286.	5159.	5023.	4883.	4740.	4587.	4457.	4342.	4231.
4118.	4005.	3891.	3778.	3665.	3553.	3443.	3333.	3226.	3120.
3038.	2968.	2898.	2830.	2762.	2694.	2628.	2562.	2498.	2434.
2372.	2310.	2250.	2191.	2133.	2077.	2021.	1967.	1913.	1861.
1810.	1761.	1716.	1677.	1637.	1597.	1558.	1520.	1483.	1447.
1411.	1377.	1343.	1310.	1278.	1247.	1217.	1187.	1159.	1130.
1103.	1076.	1050.	1025.	1000.	976.	953.	935.	917.	900.
884.	867.	851.	836.	820.	805.	790.	776.	761.	748.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6140.	5947.	5603.	4137.	347085.
CMS	174.	168.	159.	117.	9828.
INCHES		1.83	6.88	15.24	17.76
MM		46.37	174.77	387.12	451.09
AC-FT		2949.	11113.	24616.	28685.
THOUS CU M		3637.	13708.	30364.	35382.

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HYDROGRAPH ROUTING

ROUTING COMPUTATIONS - MUSCONETCONG

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	-1

STAGE	859.75	860.75	861.75	862.75	863.50	864.00	865.00	866.00	867.00
FLOW	0.00	605.00	1895.00	3400.00	3460.00	3697.00	5148.00	7535.00	10383.00

SURFACE AREA=	307.	310.	313.	316.	319.	322.	325.	328.	331.	334.
CAPACITY=	0.	308.	620.	934.	1252.	1572.	1896.	2222.	2552.	2884.
ELEVATION=	860.	861.	862.	863.	864.	865.	866.	867.	868.	869.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
859.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
863.5	0.0	0.0	0.

END-OF-PERIOD HYDROGRAPH ORDINATES

MO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	1.00	1	1.00	10.	2.	1.	859.8
1.01	2.00	2	2.00	11.	3.	1.	859.8
1.01	3.00	3	3.00	11.	4.	2.	859.8
1.01	4.00	4	4.00	12.	5.	3.	859.8
1.01	5.00	5	5.00	13.	6.	3.	859.8
1.01	6.00	6	6.00	13.	7.	4.	859.8
1.01	7.00	7	7.00	14.	8.	4.	859.8
1.01	8.00	8	8.00	14.	9.	5.	859.8
1.01	9.00	9	9.00	15.	10.	5.	859.8
1.01	10.00	10	10.00	15.	11.	5.	859.8
1.01	11.00	11	11.00	16.	11.	6.	859.8
1.01	12.00	12	12.00	16.	12.	6.	859.8
1.01	13.00	13	13.00	17.	13.	6.	859.8
1.01	14.00	14	14.00	17.	13.	7.	859.8
1.01	15.00	15	15.00	18.	14.	7.	859.8
1.01	16.00	16	16.00	23.	15.	8.	859.8
1.01	17.00	17	17.00	38.	17.	9.	859.8
1.01	18.00	18	18.00	60.	22.	11.	859.8
1.01	19.00	19	19.00	85.	30.	15.	859.8
1.01	20.00	20	20.00	109.	40.	20.	859.8
1.01	21.00	21	21.00	125.	51.	26.	859.8
1.01	22.00	22	22.00	132.	63.	32.	859.9
1.01	23.00	23	23.00	128.	73.	37.	859.9
1.02	0.00	24	24.00	121.	81.	41.	859.9
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AD-A067 766 LANGAN ENGINEERING ASSOCIATES INC CLIFTON NJ F/G 13/2
NATIONAL DAM SAFETY PROGRAM. LAKE MUSCONETCONG DAM(NJ00328). DE--ETC(U)
APR 79 D J LEARY DACW61-78-C-0124

UNCLASSIFIED NL

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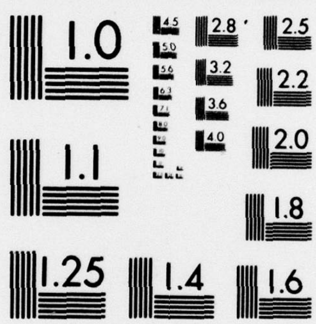

MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

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1.02	1.00	25	25.00	114.	[illegible]	44.	859.9
1.02	2.00	26	26.00	109.	90.	46.	859.9
1.02	3.00	27	27.00	107.	93.	47.	859.9
1.02	4.00	28	28.00	105.	95.	48.	859.9
1.02	5.00	29	29.00	104.	96.	49.	859.9
1.02	6.00	30	30.00	104.	97.	49.	859.9
1.02	7.00	31	31.00	108.	99.	50.	859.9
1.02	8.00	32	32.00	121.	101.	51.	859.9
1.02	9.00	33	33.00	147.	106.	54.	859.9
1.02	10.00	34	34.00	187.	115.	59.	859.9
1.02	11.00	35	35.00	238.	130.	66.	860.0
1.02	12.00	36	36.00	296.	151.	76.	860.0
1.02	13.00	37	37.00	386.	179.	91.	860.0
1.02	14.00	38	38.00	565.	224.	114.	860.1
1.02	15.00	39	39.00	888.	299.	152.	860.2
1.02	16.00	40	40.00	1483.	432.	220.	860.5
1.02	17.00	41	41.00	2399.	708.	333.	860.8
1.02	18.00	42	42.00	3513.	1366.	492.	861.3
1.02	19.00	43	43.00	4628.	2190.	681.	861.9
1.02	20.00	44	44.00	5497.	3138.	880.	862.6
1.02	21.00	45	45.00	6019.	3438.	1084.	863.2
1.02	22.00	46	46.00	6140.	3640.	1294.	863.9
1.02	23.00	47	47.00	5904.	4293.	1464.	864.4
1.03	0.00	48	48.00	5558.	4746.	1564.	864.7
1.03	1.00	49	49.00	5254.	4953.	1610.	864.9
1.03	2.00	50	50.00	5039.	5013.	1623.	864.9
1.03	3.00	51	51.00	4964.	5009.	1622.	864.9
1.03	4.00	52	52.00	4944.	4992.	1618.	864.9
1.03	5.00	53	53.00	4956.	4979.	1616.	864.9
1.03	6.00	54	54.00	5087.	4992.	1618.	864.9
1.03	7.00	55	55.00	5253.	5047.	1631.	864.9
1.03	8.00	56	56.00	5396.	5134.	1650.	865.0
1.03	9.00	57	57.00	5516.	5277.	1671.	865.1
1.03	10.00	58	58.00	5670.	5425.	1691.	865.1
1.03	11.00	59	59.00	5794.	5569.	1710.	865.2
1.03	12.00	60	60.00	5885.	5695.	1727.	865.2
1.03	13.00	61	61.00	5945.	5798.	1741.	865.3
1.03	14.00	62	62.00	5976.	5874.	1751.	865.3
1.03	15.00	63	63.00	5983.	5923.	1758.	865.3
1.03	16.00	64	64.00	5967.	5947.	1761.	865.3
1.03	17.00	65	65.00	5930.	5948.	1761.	865.3
1.03	18.00	66	66.00	5876.	5927.	1759.	865.3
1.03	19.00	67	67.00	5807.	5887.	1753.	865.3
1.03	20.00	68	68.00	5723.	5830.	1745.	865.3
1.03	21.00	69	69.00	5627.	5758.	1736.	865.3
1.03	22.00	70	70.00	5522.	5672.	1724.	865.2
1.03	23.00	71	71.00	5407.	5575.	1711.	865.2
1.04	0.00	72	72.00	5286.	5468.	1696.	865.1
1.04	1.00	73	73.00	5159.	5353.	1681.	865.1
1.04	2.00	74	74.00	5023.	5230.	1664.	865.0
1.04	3.00	75	75.00	4883.	5117.	1646.	865.0
1.04	4.00	76	76.00	4740.	[illegible]	[illegible]	[illegible]

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1.04	4.00	76	76.00	4740.	5021.	1625.	864.9
1.04	5.00	77	77.00	4587.	4909.	1600.	864.8
1.04	6.00	78	78.00	4457.	4787.	1573.	864.8
1.04	7.00	79	79.00	4342.	4666.	1546.	864.7
1.04	8.00	80	80.00	4231.	4547.	1520.	864.6
1.04	9.00	81	81.00	4118.	4430.	1494.	864.5
1.04	10.00	82	82.00	4005.	4314.	1468.	864.4
1.04	11.00	83	83.00	3891.	4199.	1443.	864.3
1.04	12.00	84	84.00	3778.	4084.	1417.	864.3
1.04	13.00	85	85.00	3665.	3970.	1392.	864.2
1.04	14.00	86	86.00	3553.	3856.	1367.	864.1
1.04	15.00	87	87.00	3443.	3743.	1342.	864.0
1.04	16.00	88	88.00	3333.	3673.	1316.	863.9
1.04	17.00	89	89.00	3226.	3627.	1285.	863.9
1.04	18.00	90	90.00	3120.	3575.	1250.	863.7
1.04	19.00	91	91.00	3038.	3517.	1211.	863.6
1.04	20.00	92	92.00	2968.	3460.	1171.	863.5
1.04	21.00	93	93.00	2898.	3449.	1128.	863.4
1.04	22.00	94	94.00	2830.	3437.	1080.	863.2
1.04	23.00	95	95.00	2762.	3424.	1027.	863.0
1.05	0.00	96	96.00	2694.	3409.	971.	862.9
1.05	1.00	97	97.00	2628.	3299.	913.	862.7
1.05	2.00	98	98.00	2562.	3067.	865.	862.5
1.05	3.00	99	99.00	2498.	2890.	828.	862.4
1.05	4.00	100	100.00	2434.	2750.	798.	862.3
1.05	5.00	101	101.00	2372.	2636.	774.	862.2
1.05	6.00	102	102.00	2310.	2538.	754.	862.2
1.05	7.00	103	103.00	2250.	2453.	736.	862.1
1.05	8.00	104	104.00	2191.	2377.	720.	862.1
1.05	9.00	105	105.00	2133.	2306.	706.	862.0
1.05	10.00	106	106.00	2077.	2240.	692.	862.0
1.05	11.00	107	107.00	2021.	2176.	679.	861.9
1.05	12.00	108	108.00	1967.	2116.	666.	861.9
1.05	13.00	109	109.00	1913.	2058.	654.	861.9
1.05	14.00	110	110.00	1861.	2001.	642.	861.8
1.05	15.00	111	111.00	1810.	1946.	631.	861.8
1.05	16.00	112	112.00	1761.	1893.	620.	861.7
1.05	17.00	113	113.00	1716.	1848.	609.	861.7
1.05	18.00	114	114.00	1677.	1804.	598.	861.7
1.05	19.00	115	115.00	1637.	1761.	588.	861.6
1.05	20.00	116	116.00	1597.	1719.	577.	861.6
1.05	21.00	117	117.00	1558.	1678.	567.	861.6
1.05	22.00	118	118.00	1520.	1638.	558.	861.6
1.05	23.00	119	119.00	1483.	1598.	548.	861.5
1.06	0.00	120	120.00	1447.	1559.	539.	861.5
1.06	1.00	121	121.00	1411.	1521.	529.	861.5
1.06	2.00	122	122.00	1377.	1484.	520.	861.4
1.06	3.00	123	123.00	1343.	1448.	512.	861.4
1.06	4.00	124	124.00	1310.	1413.	503.	861.4
1.06	5.00	125	125.00	1278.	1378.	495.	861.3
1.06	6.00	126	126.00	1247.	1344.	487.	861.3
1.06	7.00	127	127.00	[illegible]	[illegible]	[illegible]	[illegible]

1.06	7.00	127	127.00	1217.	1312.	479.	861.3
1.06	8.00	128	128.00	1187.	1280.	471.	861.3
1.06	9.00	129	129.00	1159.	1249.	464.	861.2
1.06	10.00	130	130.00	1130.	1218.	456.	861.2
1.06	11.00	131	131.00	1103.	1189.	449.	861.2
1.06	12.00	132	132.00	1076.	1160.	442.	861.2
1.06	13.00	133	133.00	1050.	1132.	435.	861.2
1.06	14.00	134	134.00	1025.	1104.	429.	861.1
1.06	15.00	135	135.00	1000.	1077.	422.	861.1
1.06	16.00	136	136.00	976.	1051.	416.	861.1
1.06	17.00	137	137.00	953.	1026.	410.	861.1
1.06	18.00	138	138.00	935.	1002.	404.	861.1
1.06	19.00	139	139.00	917.	980.	399.	861.0
1.06	20.00	140	140.00	900.	959.	394.	861.0
1.06	21.00	141	141.00	884.	939.	389.	861.0
1.06	22.00	142	142.00	867.	921.	384.	861.0
1.06	23.00	143	143.00	851.	903.	380.	861.0
1.07	0.00	144	144.00	836.	885.	376.	861.0
1.07	1.00	145	145.00	820.	869.	372.	861.0
1.07	2.00	146	146.00	805.	852.	368.	860.9
1.07	3.00	147	147.00	790.	836.	364.	860.9
1.07	4.00	148	148.00	776.	821.	360.	860.9
1.07	5.00	149	149.00	761.	805.	357.	860.9
1.07	6.00	150	150.00	748.	790.	353.	860.9

PEAK OUTFLOW IS 5948. AT TIME 65.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5948.	5914.	5518.	4099.	342826.
CMS	168.	167.	156.	116.	9708.
INCHES		1.82	6.78	15.10	17.54
MM		46.12	172.12	383.56	445.56
AC-FT		2933.	10945.	24390.	28333.
THOUS CU M		3617.	13500.	30085.	34948.

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RUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES(SQUARE KILOMETERS)

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	15026.	14418.	10167.	4450.	25.40
		(425.48)	(408.27)	(287.88)	(126.02)	(65.79)
ROUTED TO	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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ROUTED TO	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		(159.70)	(158.56)	(144.51)	(96.45)	(65.79)
HYDROGRAPH AT	2	5580.	4978.	2530.	912.	4.90
		(158.01)	(140.97)	(71.63)	(25.82)	(12.69)
2-COMBINED	2	6140.	5947.	5603.	4137.	30.30
		(173.86)	(168.40)	(158.66)	(117.14)	(78.48)
ROUTED TO	3	5948.	5914.	5518.	4099.	30.30
		(168.42)	(167.47)	(156.25)	(116.07)	(78.48)

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1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	923.30	923.30	927.70
STORAGE	0.	0.	11050.
OUTFLOW	0.	0.	3073.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	929.34	1.64	15245.	5640.	37.00	65.00	0.00

1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	859.75	859.75	863.50
STORAGE	0.	0.	1172.
OUTFLOW	0.	0.	3460.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	865.34	1.84	1761.	5948.	46.00	65.00	0.00

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1**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION   25 SEP 78
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MUSOUT2     07:53 FEB 06,'79

1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION        JULY 1978
   LAST MODIFICATION  25 SEP 78
 **********************************
1                                PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                                        RUNOFF HYDROGRAPH AT           1
                                        ROUTE HYDROGRAPH TO            2
                                        RUNOFF HYDROGRAPH AT           2
                                        COMBINE  2 HYDROGRAPHS AT      2
                                        ROUTE HYDROGRAPH TO            3
                                        END OF NETWORK

1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION        JULY 1978
   LAST MODIFICATION  25 SEP 78
 **********************************

 RUN  DATE$ 79/02/06.
      TIME$ 07.48.21.


                                          LAKE MUSCONETCONG DAM
                                          $ PMP
                                          N.J. DAM INSPECTION

                                                 JOB SPECIFICATION
                     NQ      NHR     NMIN     IDAY      IHR     IMIN    METRC     IPLT     IPRT    NSTAN
                    150        1        0        0        0        0        0        0        4        0
                                               JOPER      NWT    LROPT    TRACE
                                                   5        0        0        0

                                         MULTI-PLAN ANALYSES TO BE PERFORMED
                                              NPLAN= 1 NRTIO= 8 LRTIO= 1
                       RTIOS=   1.00     .90     .80     .70     .60     .50     .40     .30


               **********          **********          **********          **********          **********

                                             SUB-AREA RUNOFF COMPUTATION
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COMPUTE HYDROGRAPH - HOPATCONG LOCAL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	25.40	0.00	25.40	.82	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.40	104.00	113.00	123.00	135.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.15	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 12.00 CP= .58 NTA= 0

RECESSION DATA

STRTQ= -2.00 QRCSN= 0.00 RTIOR= 1.00

UNIT HYDROGRAPH 75 END-OF-PERIOD ORDINATES, LAG= 12.03 HOURS, CP= .58 VOL= 1.00

19.	70.	143.	229.	323.	424.	528.	624.	701.	760.
799.	817.	807.	764.	707.	653.	604.	559.	517.	478.
442.	408.	378.	349.	323.	298.	276.	255.	236.	218.
202.	186.	172.	159.	147.	136.	126.	117.	108.	100.
92.	85.	79.	73.	67.	62.	58.	53.	49.	45.
42.	39.	36.	33.	31.	28.	26.	24.	22.	21.
19.	18.	16.	15.	14.	13.	12.	11.	10.	9.
9.	8.	7.	7.	6.					

0

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	24.80	19.82	4.98	330800.
										(630.)	(503.)	(126.)	(9367.21)

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HYDROGRAPH ROUTING

ROUTING COMPUTATIONS - HOPATCONG

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

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     QLOSS    CLOSS      AVG     IRES   ISAME    IOPT    IPMP             LSTR
       0.0    0.000     0.00        1       0       0       0                0

              NSTPS    NSTDL      LAG   AMSKK       X     TSK   STORA   ISPRAT
                  1        0        0   0.000   0.000   0.000      0.       -1
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STAGE	923.30	924.30	925.30	926.30	927.70	928.70	929.70	930.70	931.70	
FLOW	0.00	333.00	942.00	1730.00	3073.00	4497.00	6291.00	8355.00	10651.00	
SURFACE AREA=	2474.	2491.	2508.	2525.	2542.	2559.	2576.	2593.	2610.	2627.
	2644.	2661.								
CAPACITY=	0.	2482.	4982.	7498.	10032.	12582.	15150.	17734.	20336.	22954.
	25590.	28242.								
ELEVATION=	923.	924.	925.	926.	927.	928.	929.	930.	931.	932.
	933.	934.								

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
923.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
927.7	0.0	0.0	0.

PEAK OUTFLOW IS 5640. AT TIME 65.00 HOURS

PEAK OUTFLOW IS 4804. AT TIME 66.00 HOURS

PEAK OUTFLOW IS 4032. AT TIME 66.00 HOURS

PEAK OUTFLOW IS 3296. AT TIME 67.00 HOURS

PEAK OUTFLOW IS 2679. AT TIME 68.00 HOURS

PEAK OUTFLOW IS 2120. AT TIME 69.00 HOURS

PEAK OUTFLOW IS 1574. AT TIME 70.00 HOURS

PEAK OUTFLOW IS 1079. AT TIME 71.00 HOURS

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                          SUB-AREA RUNOFF COMPUTATION

      COMPUTE HYDROGRAPH - MUSCONETCONG LOCAL

                   ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                       2       0       0       0       0       0       1       0       0

                                  HYDROGRAPH DATA
      IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
          1       1    4.90    0.00    4.90     .80   0.000       0       0       0

                                    PRECIP DATA
              SPFE     PMS      R6     R12     R24     R48     R72     R96
              0.00   22.40  112.00  123.00  132.00  142.00    0.00    0.00

                                     LOSS DATA
     LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
         0    0.00    0.00    1.00    0.00    0.00    1.00    1.00     .15    0.00    0.00

                               UNIT HYDROGRAPH DATA
                           TP=  6.00     CP= .58     NTA=   0

                                  RECESSION DATA
                   STRTQ=    -2.00    QRCSN=     0.00    RTIOR= 1.00

     UNIT HYDROGRAPH 37 END-OF-PERIOD ORDINATES, LAG=   6.00 HOURS, CP=  .58  VOL= 1.00
       19.       70.      140.      214.      276.      309.      308.      274.      233.      198.
      168.      143.      122.      103.       88.       75.       63.       54.       46.       39.
       33.       28.       24.       20.       17.       15.       12.       11.        9.        8.
        6.        5.        5.        4.        3.        3.        2.

 0                                END-OF-PERIOD FLOW
MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q     MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                        SUM  25.45  20.64   4.81   66438.
                                                                           ( 646.)( 524.)( 122.)( 1881.31)

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                                 COMBINE HYDROGRAPHS

      COMBINE OUTFLOW OF HOPATCONG WITH LOCAL INFLOW OF MUSCONETCONG

                   ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
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                2    2    0    0    0    0    1    0    0

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                         HYDROGRAPH ROUTING

          ROUTING COMPUTATIONS - MUSCONETCONG

                ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                    3       1       0       0       0       0       1       0       0
                                      ROUTING DATA
       QLOSS    CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
         0.0    0.000    0.00       1       0       0       0               0

                NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                    1       0       0   0.000   0.000   0.000      0.      -1

  STAGE     859.75    860.75    861.75    862.75    863.50    864.00    865.00    866.00    867.00
   FLOW       0.00    605.00   1895.00   3400.00   3460.00   3697.00   5148.00   7535.00  10383.00

SURFACE AREA=     307.     310.     313.     316.     319.     322.     325.     328.     331.     334.

   CAPACITY=       0.     308.     620.     934.    1252.    1572.    1896.    2222.    2552.    2884.

  ELEVATION=     860.     861.     862.     863.     864.     865.     866.     867.     868.     869.

                 CREL   SPWID    COQW    EXPW   ELEVL    COQL   CAREA    EXPL
                859.8     0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                        DAM DATA
                               TOPEL    COQD    EXPD  DAMWID
                               863.5     0.0     0.0      0.

PEAK OUTFLOW IS     5948. AT TIME  65.00 HOURS

PEAK OUTFLOW IS     5020. AT TIME  66.00 HOURS

PEAK OUTFLOW IS     4215. AT TIME  67.00 HOURS

PEAK OUTFLOW IS     3422. AT TIME  50.00 HOURS
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PEAK OUTFLOW IS 3086. AT TIME 49.00 HOURS

PEAK OUTFLOW IS 2527. AT TIME 49.00 HOURS

PEAK OUTFLOW IS 1970. AT TIME 49.00 HOURS

PEAK OUTFLOW IS 1445. AT TIME 49.00 HOURS

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1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .90	RATIO 3 .80	RATIO 4 .70	RATIO 5 .60	RATIO 6 .50	RATIO 7 .40	RATIO 8 .30
HYDROGRAPH AT	1	25.40	1	15026.	13523.	12020.	10518.	9015.	7513.	6010.	4508.
	(	65.79)	(	425.48)(	382.93)(	340.38)(	297.83)(	255.29)(	212.74)(	170.19)(	127.64)(
ROUTED TO	2	25.40	1	5640.	4804.	4032.	3296.	2679.	2120.	1574.	1079.
	(	65.79)	(	159.70)(	136.04)(	114.18)(	93.32)(	75.85)(	60.02)(	44.57)(	30.55)(
HYDROGRAPH AT	2	4.90	1	5580.	5022.	4464.	3906.	3348.	2790.	2232.	1674.
	(	12.69)	(	158.01)(	142.20)(	126.40)(	110.60)(	94.80)(	79.00)(	63.20)(	47.40)(
2 COMBINED	2	30.30	1	6140.	5499.	4859.	4217.	3605.	3004.	2403.	1803.
	(	78.48)	(	173.86)(	155.72)(	137.58)(	119.42)(	102.07)(	85.07)(	68.06)(	51.04)(
ROUTED TO	3	30.30	1	5948.	5020.	4215.	3422.	3086.	2527.	1970.	1445.
	(	78.48)	(	168.42)(	142.16)(	119.36)(	96.90)(	87.40)(	71.57)(	55.79)(	40.92)(

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SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	923.30	923.30	927.70
STORAGE	0.	0.	11050.
OUTFLOW	0.	0.	3073.

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RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	929.34	1.64	15245.	5640.	37.00	65.00	0.00
.90	928.87	1.17	14047.	4804.	32.00	66.00	0.00
.80	928.37	.67	12771.	4032.	25.00	66.00	0.00
.70	927.86	.16	11449.	3296.	13.00	67.00	0.00
.60	927.29	0.00	10004.	2679.	0.00	68.00	0.00
.50	926.71	0.00	8525.	2120.	0.00	69.00	0.00
.40	926.10	0.00	6999.	1574.	0.00	70.00	0.00
.30	925.47	0.00	5418.	1079.	0.00	71.00	0.00

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SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	859.75	859.75	863.50
STORAGE	0.	0.	1172.
OUTFLOW	0.	0.	3460.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	865.34	1.84	1761.	5948.	46.00	65.00	0.00
.90	864.91	1.41	1625.	5020.	42.00	66.00	0.00
.80	864.36	.86	1446.	4215.	36.00	67.00	0.00
.70	863.03	0.00	1022.	3422.	0.00	50.00	0.00
.60	862.54	0.00	869.	3086.	0.00	49.00	0.00
.50	862.17	0.00	752.	2527.	0.00	49.00	0.00
.40	861.80	0.00	636.	1970.	0.00	49.00	0.00
.30	861.40	0.00	511.	1445.	0.00	49.00	0.00

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FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 25 SEP 78
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APPENDIX 5

REFERENCES

LAKE MUSCONETCONG DAM

APPENDIX 5

REFERENCES

LAKE MUSCONETCONG DAM

1. Memorandum to President & Board of Directors, Morris Canal & Banking Co., from C.C. Vermeule, dated 13 July 1925.

2. Report titled "Improvement of Lake Musconetcong," by C.C. Vermuele, Morris Canal & Banking Co., dated 20 Dec. 1930.

3. Memorandum to Mr. A.L. Sherman, State Water Policy Commission, from H.T. Critchlow, dated 21 May 1931.

4. Letter to Mr. H.T. Critchlow from C.C. Vermeule, dated 29 May 1931.

5. Letter to Mr. A.L. Sherman, from C.C. Vermeule, dated 29 May 1931.

6. Memorandum to Mr. C.C. Vermeule from H.T. Critchlow, dated 2 June 1931.

7. Letter to Mr. H.T. Critchlow from C.C. Vermeule, dated 4 June 1931.

8. Memorandum to Mr. A.L. Sherman from H.T. Critchlow, dated 6 June 1931.

9. Letter to Mr. C.C. Vermeule from H.T. Critchlow, dated 9 June 1931.

10. Letter to Mr. H.T. Critchlow from C.C. Vermeele, dated 11 June 1931.

11. Report on Dam Application #186, by J.N. Brooks and H.T. Critchlow, dated 3 July 1931.

12. Acknowledgement of Application for Permit for Construction or Repair of Dam, to Dr. H.B. Kummel, Morris Canal & Banking Company, dated 21 July 1931.

13. Permit to Morris Canal & Banking Company by State Water Policy Commission, dated 29 July 1931.

14. Inspection Report by G.R. Shanklin, dated 8 Aug. 1932.

15. Annual Report by M. Berkowitz, dated 5 June 1968.

16. Chow, Ven Te, Ph.D, Open Channel Hydraulics, McGraw-Hill Book Company, 1959.

17. United States Dept. of Agriculture, Soil Conservation Service SCS National Engineering Handbook Section 4 Hydrology NEH-Notice 4-102, August 1972.

18. United States Dept. of Agriculture, Soil Conservation Service, Somerset, N.J. Urban Hydrology for Small Watersheds, Technical Release No. 55, January 1975.

19. United States Dept. of Commerce Weather Bureau, April 1956 Hydrometeorological Report No. 33, Washington, D.C.

20. United States Dept. of Interior, Bureau of Reclamation Design of Small Dams, Second Edition 1973, Revised Print 1977.

21. Wolfe, P.E., 1977, The Geology and Landscapes of New Jersey, Crane, Russak & COmpany, Inc., New York, New York, 351 pp.

Drawings

1. Dwg No 150, General Plan of Dam Section Thru Culvert, by Morris Canal & Banking Co., dated 1 July 1, 1925.

2. Dwg No 151, Elevations Sections Gatehouse, by Morris Canal & Banking Co., dated 1 July 1925.

3. Dwg No 152, Concrete & Steel Details, by Morris Canal & Banking Co., dated 1 July 1925.

4. Plan of Reinf. of Cap of Present Spillway, By C.C. Vermeule, approved by State Water Policy Commission July 1931.

5. Longitudinal Sections with Elevation of Spillway, by C.C. Vermeule, approved by State Water Policy Commission July 1931.